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ENGLISH COINS.—III.*

By G. F. Hill, M.A.

THE union of the English and Scottish Crowns in 1603 did not lead to any unification of the currency. James I. continued to strike separate series for both parts of his kingdom, but there are frequent allusions in his coinage to the union of the two countries. The most important is found in the shield, which now bore, in the first and fourth quarters, France and England quarterly; in the second, Scotland; in the third, Ireland. James's first gold coinage consisted of sovereigns, half-sovereigns, crowns, and half-crowns, all of which have the Scottish thistle for mint-mark. But this was replaced in the same or the next year by a gold coinage, the largest piece in which, though of the same value as the old sovereign, was known as the "unite" (Fig. 1). On this coinage the king is called "King of Great Britain, France, and Ireland," and the legend of the reverse (FACIAM EOS IN GENTEM VNAM) gave rise to the name of the coin. In 1611 these pieces were given a value of twenty-two shillings, the weight remaining the same (about one hundred and fifty-four grains troy); but in 1619 the old value was restored, the weight being reduced proportionally. At the same time for the old crowned bust was substituted a laureated one (Fig. 2), which gave the name of "laurel" to the coin. Yet a third name was the "broad." Besides the unite, we may mention among the gold coins of James I., the "Britain crown," with the motto HENRICVS ROSAS (conjunxit) REGNA IACOBVS ("Henry united the Roses, James the Realms"), and the "thistle crown," bearing a rose on one side, a thistle on the other, with TVEATVR VNITA DEVS ("God protect the United Kingdoms"). This was worth at first four shillings, but was raised in 1611 in proportion to the unite. The denomination was not issued again in gold. An exceptional place in the coinage of this reign is occupied by the rose ryal* of thirty shillings (afterwards raised to thirty-three), the spur ryal of fifteen shillings (16s. 6d.), the angel of ten shillings (11s.), and its half. "Spur ryal" is a misnomer, occasioned by the rose on a sun, which appears on the reverse, and has been taken for a spur. These coins belong rather to the series of James's predecessors than to the new type of coins which he introduced. From this time onwards there is a tendency towards reducing the number of denominations; Charles I. coined no ryals, and was the last to coin angels.

In silver, James made an alteration in the type of the crowns and half-crowns, which now represented the king riding on horseback to the right (Fig. 3), a rose (crowned) on the housings, and the motto EXVRGAT DEVS DISSIPENTVR INIMICI (Psalm lxviii. 1), or QVÆ DEVS CONIVNXIT NEMO SEPARET (Matt. xix. 6, again an allusion to the union of the kingdoms). On the shillings the king's bust to the right is the type. From this time we may note in the English coinage the principle that each sovereign reverses the direction of the obverse type adopted by his predecessor. Thus the types on the coins of Elizabeth and Charles I., when profiles, look to the left, those of James I. to the right. The rule was broken by Charles II. and James II., but thenceforward has been rigidly observed.

In 1613 a patent was granted to Lord Harrington of Exton to coin copper farthings (Fig. 4). They are very common, and equally common were the forgeries which were made of them at the time. The obverse type is a crown over two sceptres in saltire, the reverse a crowned harp, which gives them an Irish appearance. Owing to the number of counterfeits which were made, these coins were exceedingly unpopular, but they were forced upon the public throughout the reign of James and the first ten years of that of Charles.

The reign of Charles I. did not see any important alteration in the coinage, but at the same time the troubles of the reign could not but be reflected in the coins, and lend them an unusual interest. The legends employed by James were replaced by others, as on the angel here figured (Fig. 6), which reads AMOR POPVLI PRÆSIDIVM REGIS. The facts of the reign lend a peculiar irony to this as to many others of the legends of Charles I.'s coinage. Another legend of interest is that relating to the declaration made by the king, in 1642, that he would preserve the Protestant religion, the laws of England, and the freedom of Parliament. This is recorded, for instance, on the fine three-pound pieces, which read RELIGIO PROTestans, LEGes ANGliæ LIBERtas PARliamenti, with a motto revived

* The first of these articles appeared in the May and the second in the August numbers of KNOWLEDGE.

* The ryal, or rial (from *royal*), was a gold coin which fluctuated in value from ten shillings sterling in the reign of Henry VI, and fifteen shillings in that of Elizabeth, to the amounts mentioned in the text.

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from the coinage of James I. These pieces were struck at Oxford, the only mint besides that at Bristol from which gold is certainly known to have been issued.

The number of mints for silver was, however, considerable, the most important being the Tower. Among the silver coins, particular notice is due to the crown, which was designed at Oxford by the engraver Rawlins, but which probably never came into circulation (Fig. 5). The work, though somewhat finicking, is above the average, and the piece gains a special interest from the view of Oxford, in which the tower of Magdalen and the spires of St. Mary's and another church, as well as the fortifications, are clearly discernible. The signature R is in the left-hand corner. The reverse bears the Declaration. Another famous engraver of the time was Nicholas Briot, a Frenchman, who was employed in England from 1628, and whose work is exceedingly neat, though wanting in spirit. The angel here figured (Fig. 6) is from his hand.

Several of the fortresses which were besieged in the Civil Wars produced an irregular currency—known as siege-pieces, or money of necessity—to supply the want of ordinary money. These were supposed to be redeemable at the close of the siege. The rudeness with which some of them were executed is well shown by the piece of Scarborough (Fig. 8), which is merely a piece of silver plate doubled up and stamped on one side with a representation of the keep, and the value (ii. S. vi. D.), on the other with OBS *Scarborough* 1645. The castle of Pontefract held out after the death of Charles I., and we find siege-pieces struck there in the name of Charles II. with the motto POST MORTEM PATRIS PRO FILIO.

The abuse of the farthing coinage instituted by James I. led Charles, in 1635, to issue, no longer by contract but under his own direct authority, a series of farthings, differing from the old issue mainly in having the harp replaced by a rose. These were known as "rose" or "royal farthings," as opposed to the old "Harringtons."

The Commonwealth coinage is somewhat uninteresting, owing to the fact that the device on all denominations except the halfpenny is the same, viz.: on the obverse, in a wreath composed of branches of palm and laurel, a shield bearing St. George's cross; on the reverse, two shields bearing St. George's cross and the Irish harp. The appearance of the reverse gave rise to the nickname "breeches-money." The legends are in English: THE COMMONWEALTH OF ENGLAND and GOD WITH VS. The illustration (Fig. 7) is of a gold crown of 1650. The halfpenny has simply shields with the cross of St. George on one side and with the harp on the other, without legend, date, or value.

In 1656 and 1658 the mint produced several pieces in gold and silver bearing a fine portrait of Oliver Cromwell. These were executed by Thomas Simon with the mill and screw, instead of with the hammer, which had been commonly used under the Stuarts. But these pieces were never put into circulation, Cromwell probably fearing to assert his personal power in this way. For the sake of the portrait a pattern for the "broad" may be illustrated (Fig. 9).

Some of the gold and silver patterns made at this time furnish the first instance of an inscription on the edge of a coin. The motto, DECVS ET TVTAMEN, which now protects, though hardly ornaments, the edge of our crown pieces, first occurs on the five-guinea pieces of Charles II.

A large number of patterns for copper coins were made during the Commonwealth, but none appear to have been put in circulation. Many of the patterns from this time are made of two metals, as of brass with a copper centre, or a copper centre enclosed in a ring of bell-metal, or with a brass obverse and a copper reverse. The Commonwealth copper patterns have all English legends, as: ENGLAND'S FARDIN; reverse, FOR NECESSARY CHANGE.

The Restoration brought about a return to the old types and the old method of hammering. Before long, however (1662), the mill was re-introduced, and this time for good.

In order to establish the new process, Blondeau, who had perfected it, was brought over from Paris. A previous attempt to bring him over, as early as 1649, had failed, owing to the jealousy of the English officials. He was now appointed to strike coins from dies provided by Thomas Simon, and by John Roettier, a native of Antwerp. Simon is undoubtedly the greatest of the engravers of English coins, but Roettier's patterns were preferred, and this caused Simon to produce the splendid piece known as the "Petition Crown" (Fig. 11). Round the edge runs the petition: *THOMAS SIMON* MOST HVMBLY PRAYS YOVR *MAJESTY* TO COMPARE THIS HIS TRYALL PIECE WITH THE DVTCH AND IF MORE TRVLY DRAWN & EMBOSS'D MORE GRACEFVLLY ORDER'D AND MORE ACCVRATELY ENGRAVEN TO RELEIVE HIM. For delicacy and finish, both of design and of execution, this piece has never been surpassed.

The value of the gold coins struck with the hammer was slightly raised in 1661, and the new gold pieces struck from Roettier's dies with Blondeau's mill were made somewhat lighter in proportion. The twenty-shilling pieces were struck at $131\frac{2\,9}{4\,1}$ grains, and were known as Guineas, to distinguish them from the older broads. The name is due to the fact that most of the gold used for these coins was brought from Guinea by the African Company. In 1670 the weight of the guinea was reduced to $129\frac{3\,0\,7}{8\,9}$ grains, at which it subsequently remained. The specimen illustrated (Fig. 10) is one of the first struck. There were also five-guinea, two-guinea, and half-guinea pieces. In this reign Maundy money of groats, threepences, half-groats, and pennies was first issued.

In copper, in the reign of Charles II. we have issues of halfpence and farthings; there are also farthings in tin, with a square stud of copper in the centre. The copper coins were not issued for currency till 1672, of which date is the halfpenny here illustrated (Fig. 12). On these coins for the first time appears the figure of Britannia. It was doubtless suggested by the design of some Roman pieces, but it is at the same time a portrait of the famous Duchess of Richmond.

We may pass over the next two reigns, only mentioning that by the time of the sole reign of William III. the silver coins had deteriorated so much in quality that the guinea passed current for thirty shillings, *i.e.*, fifty per cent. above its nominal value. The guinea, however, fell to its old value during William's reign, owing to the increased coinage of silver.

Copper (in both halfpence and farthings) was also coined to such a great extent in this reign that no fresh issue was necessary on the accession of Anne. Towards the end of her reign several patterns for copper coins were made. Among these is the Queen Anne's farthing (Fig. 14), with regard to the rarity of which the most absurd errors are prevalent. Of this coin, which, perhaps, was never actually in circulation, there is no lack of specimens. Another common error is to mistake copper or brass counters for the farthing; these were made in imitation of the silver sixpence, and therefore bear on the reverse the four shields instead of the figure of Britannia. The engraver of the farthing, as of many other coins of this time, was Croker, or Crocker, a German. The bust of Anne on her coinage is draped; her modesty, it is said, having induced her to alter the fashion of her predecessors.

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ENGLISH AND IRISH COINS.

Some of the gold coins of Anne have an elephant and castle placed under the bust, in token of the fact that they are made of gold brought to England by the African Company. Other pieces, both of gold and silver, struck in 1702 and 1703 out of metal captured at Vigo, in 1702, bear the name of that town. After the union with Scotland in 1707 an alteration was effected in the arms. These had been represented on four shields placed crosswise: the arms of England at the top, of France at the bottom, of Scotland to the right, and of Ireland to the left. The arms of England and Scotland impaled were now placed in the top and bottom shields, and France transferred to the right.

The accession of George I. brought about some slight alterations in the coinage. The letters F D (Fidei Defensor) were now for the first time added to the king's title. Besides this, a string of letters denote George's title as Duke of Brunswick and Luneburg, Chief Treasurer and Elector of the Holy Roman Empire. The arms of Hanover are now placed in the left-hand shield and the Irish harp in the bottom one, the others remaining as before.

In 1717 the value of the guinea was fixed at twenty-one shillings, which it retained until the re-introduction of the sovereign. In the next year quarter-guineas were also struck for the first time.

George II.'s coinage hardly calls for remark. After Crocker's death in 1740, John Sigismund Tanner was made Chief Engraver to the Mint; and it is possible that the slang term for a sixpenny piece is derived from his name. Some of the gold coins of this reign, either because they were issued for the East India Company or because they were made of gold from India, bear the letters E I.C. under the bust. Others, both gold and silver, of the years 1745 and 1746, read LIMA. The metal for these pieces came from Peru, whence Lord Anson had brought a quantity of bullion in 1744.

The reign of George III. is perhaps the most disgraceful period in the history of the later English coinage. In 1762 the issue of quarter-guineas was temporarily revived; in 1797 a new denomination of seven shillings, or one-third of a guinea, was issued. But the coinage of five and two guinea pieces was dropped, and even the ordinary gold currency was allowed to deteriorate to a very serious extent. As to the silver, it was excessively scanty and in a worn condition. With one small exception (one hundred pounds worth of shillings struck in 1763 for a special purpose) no silver beyond the usual Maundy money was issued until 1787.

The issue of 1763 was made on the occasion of the Earl of Northumberland's first public appearance as Lord Lieutenant of Ireland, when the shillings were distributed among the Dublin populace. By 1787 the silver coinage had become so worn that pieces on which nothing could be made out passed current. The shillings and sixpences now issued were quickly melted down, and now the Government resorted to the device of countermarking Spanish dollars to make them legal tender in England (Fig. 13, with the king's head), or even of completely re-striking the Spanish coins. It was not till 1817 that an entirely new coinage was issued. Guineas, half-guineas, and seven-shilling pieces were last coined in 1813; the sovereign, of 123·27447 grains (Fig. 15), and the half-sovereign, were now introduced. The dies for the early coinage of George III. had been engraved by Lewis Pingo. He was now replaced by Thomas Wyon, but the designs of a number of the coins were made by Pistrucci. To this somewhat over-rated artist the design of St. George and the Dragon, which now appeared on the reverse of the sovereign and crown, was due. It is not wanting in spirit, but has many faults. The admiration it excited at the time was partly due to the excellent way in which it was produced by the Mint. The reverse of the half-sovereign bore the royal arms.

No copper coinage was issued until the year 1770. From 1775 to 1797 there was again a cessation of copper coinage. The last year saw the first and last coinage of the "cart-wheel" type, including the only two-penny piece ever officially issued in copper. These pieces have a broad rim raised above the level of the *flan* and bearing the inscription. The coins were designed by Küchler. Another extensive copper coinage was issued in 1806 and 1807.

The new gold coinage of 1816 differs from the earlier issues in that the coins are smaller and thicker, and that the rim assumes a greater importance. The sovereigns will pack together more firmly than the old guineas, in which the rim was not raised to any appreciable height. The change is an improvement only from a commercial point of view, for it detracts from the value of the relief, such as it is. At the same time, the execution of the coinage of this period is an improvement on the last century, and infinitely superior to that of the present day.

The union of the kingdoms of Great Britain and Ireland in 1800 caused a further change in the arms. They were now quarterly—first and fourth England, second Scotland, third Ireland; the Hanoverian arms were borne on an escutcheon of pretence, and the arms of France abandoned with the title.

The coinage of George IV. is lacking in interest. It is only necessary to mention that in this reign a double sovereign was struck. Pistrucci engraved the dies. In 1824 he was ordered to engrave a portrait from a bust by Chantrey, but refused to work from any but his own models. The task was therefore given partly to William Wyon, partly to the Frenchman, J. B. Merlin.

Under William IV. some experiments were made with the coinage. The Masters of the Mint have been abused for abolishing the armorial device on the shillings and sixpences, and substituting the name of the denomination. The value had long been indicated on the smaller coins, and the art of the period was so bad that we can hardly find fault with the authorities for introducing what was at any rate a practical improvement.

In 1836 groats were once more issued for general circulation. They were continued into the next reign, but since 1856 have only been issued for Maundy purposes. The copper coins of this reign are somewhat rare, only a comparatively small number having been struck.

Pistrucci's St. George and the Dragon disappeared from the coins at the beginning of the present reign, and was replaced by a shield of arms, from which, of course, the arms of Hanover were removed. The portrait is by William Wyon, and is not unpleasing. Pistrucci's design was revived in 1871 for the reverse of the sovereign, in 1887 for the crown, in 1893 for the half-sovereign. In 1849 the florin was first coined. The bust was represented crowned, a revival from the times of Charles II. For some reason the words *Dei Gratia* were omitted on the first florin, which therefore goes by the name of the "godless florin." The mistake was rectified in the next and succeeding issues, in which the legends are in Old English characters.

From 1845 onwards the threepenny piece, of the same type as the Maundy money, has been issued at intervals for circulation.

In 1860 a change was made in the copper coinage, bronze (ninety-five parts of copper to four of tin and one of zinc) being substituted for copper, and the size of the

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coins being diminished. The bust was by L. C. Wyon. On the reverse the lighthouse and ship appeared for the first time.

The changes of the last few years are familiar to all, and need not be described, the more so as they have been almost uniformly for the worse. It may be noted that the striking of five-pound and two-pound pieces was revived in the year of the Jubilee (when the denomination of four shillings was also issued), and in 1893. The title of Empress of India first appears in the latter year.

Among the experiments of the reign may be mentioned the pattern five-pound piece of 1839 by W. Wyon, representing the Queen as Una with the lion. The piece is well executed, but when the design is considered it is a matter of congratulation that the piece remained a pattern. In 1855 and in 1872 mints were established at Sydney and Melbourne, and in 1863 and 1866 the coins issued from colonial mints, established or to be established, were made legal tender. The first Sydney coins bore AUSTRALIA across the field, SYDNEY MINT above, and the value below; but the later coins of Sydney and Melbourne are only distinguished from the others by the mint marks S and M. The mint mark H, which occurs on some of the bronze coins, is the mark of Heaton's mint at Birmingham.

Among the silver patterns the most interesting is the "Gothic crown" of 1846 and 1847 (Fig. 16), so called from the Old English lettering.

Patterns have been struck at various times for a decimal currency, some of them at the Mint, others by private persons. Of the former class very few are to be seen outside the Mint museum itself.

It has already been mentioned that the scarcity of small change had necessitated the production of a token coinage. The great mass of the tokens belong to the seventeenth and eighteenth centuries. Of the town tokens Fig. 17 represents a halfpenny of Wimborne (FOR THE VSE OF THE POORE OF WIMBORNE 1669; reverse, THEIR HALFPENNY; two women at a wash-tub). In London an enormous number of tradesmen issued their own tokens. Fig. 18 is a token of the Salutation Tavern (AT YE SALUTATION IN LOMBARD; two gentlemen saluting each other; reverse, STREET HIS HALFPENNY; in the centre the initial of the owner's surname is put above, H, those of his own and his wife's Christian names below, T M). Of eighteenth century tokens, those of the Paris Copper Mine Company, struck at Anglesea, are among the commonest. The obverse of the variety here illustrated (Fig. 19) bears a Druid's head; the reverse, the Company's initials in monogram, the date 1787, and WE PROMISE TO PAY THE BEARER ONE PENNY. On the edge: ON DEMAND IN LONDON, LIVERPOOL, OR ANGLESEY. The rarity of silver in the reign of George III. necessitated the issue of tokens to supply the place of silver coinage. Thus the Bank of England issued tokens for five shillings, three shillings, and eighteen pence (Fig. 21); the Bank of Ireland for six shillings, thirty pence, ten pence, and five pence. Besides these tokens, a large number of pieces, some with more or less fanciful designs and legends, some with political allusions, seem to have got into circulation, though there is little doubt that many of them were never meant to pass as coins, and were made for collectors. The production of private tokens for small change fell off after the issue of copper in 1806 and 1807, but the Bank tokens mentioned above are later.

The Scottish coinage ceases to have much interest from the time of the union of the two Crowns. There is a considerable variety of denominations with peculiar names, such as "bawbee" (derived possibly from the name of a mint master, the laird of Sillebawby), "bodle" (Bothwell?), "turner" (French *tournois*). The separate coinage ceases with the union in 1707.

In the reign of Charles I. a considerable amount of money was struck in Ireland. Not to mention the siege-pieces, we may note the so-called Ormonde money, which was struck out of silver plate, with C R crowned on one side and the value on the other.

Among the most interesting of the Irish coins are the St. Patrick's halfpence and farthings. The former represent a king kneeling and playing the harp, with FLOREAT REX; on the reverse, St. Patrick with his flock, ECCE GREX The farthings (Fig. 22) have a similar obverse, but on the reverse the saint is represented driving out snakes and dragons; QVIESCAT PLEBS. These were struck in the reign of Charles II., but precisely for what purpose we cannot say.

The most important pieces in the later Irish coinage are undoubtedly the money of necessity issued by James II. after his abdication of the English throne. These are all made of bronze or gun-metal, and therefore known as gun-money. They were issued in the various denominations from the crown downwards. A peculiarity is that, besides the usual date of the year, they bear the name of the month in which they were struck. Thus the half-crown here illustrated (Fig. 20) was struck in March, 1689 (reckoning according to the civil year, which began on March 25th, for the order to coin this money was not issued till the 18th of June, 1689, of the historical year).

In spite of the union in 1800, the Irish coinage does not cease until 1823.

Here our sketch of the coinage of these islands must close. It has been impossible to do more than draw attention to the more important features in the history of our currency; while that of our dependencies we have had to pass over in silence. One point, it is hoped, has been made sufficiently clear: the Mint of our own days has a good deal to learn from the older coinage in the matter of technique. The Gothic crown showed a praiseworthy attempt to produce a decorative effect, but its archaisms were out of place. And if it is impossible to find a good design, it should be at least possible to strike the coins clearly. The Petition crown of Simon is sufficiently modern to serve as an indication of the spirit in which our coins should be decorated, and the finish with which they should be produced.

OUR FUR PRODUCERS.—V.

THE CAT TRIBE, CIVETS, AND MONKEYS.

By R. Lydekker, B.A.Cantab., F.R.S.

THE whole of the four preceding sections of the present subject have been devoted to the furs afforded by the carnivora—either terrestrial or aquatic—but there still remain for consideration in the same great order the cat tribe (*Felidæ*), as well as the less important group of the civets and their allies (*Viverridæ*). Whereas the majority of the furs hitherto mentioned are more or less uniformly coloured, and are obtained from medium-sized or small animals, a considerable proportion of those yielded by the cat tribe have dark stripes or spots upon a light and frequently brilliantly-coloured ground, and many of these are of large size and the skins very thick. Consequently, such are much used as ornamental rugs or coverings.

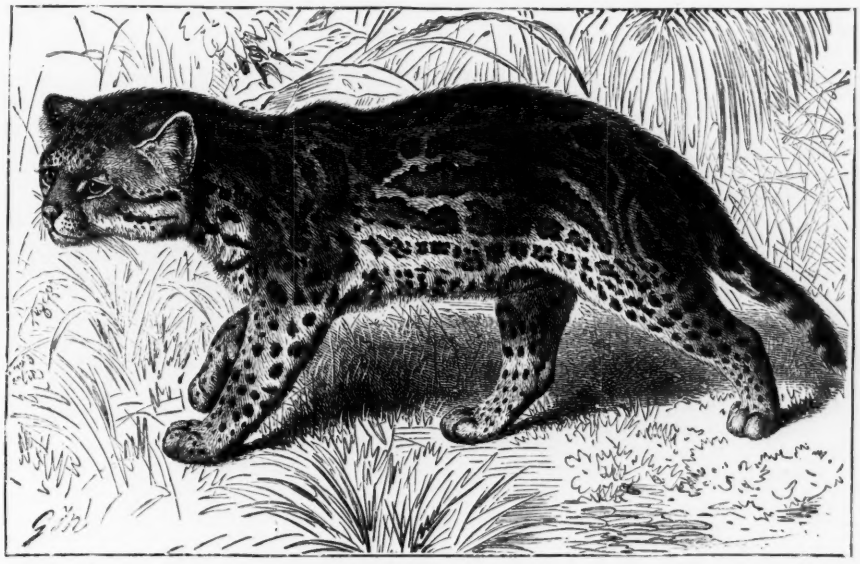
As exceptions to the general type of coloration obtaining among the *Felidæ*, we may first of all refer to the lion of the Old World and the puma of America, in both of which

the fur is normally of a uniform tawny hue (save the mane and tail-tip of many lions), although traces of spots may be detected in the young, and sometimes, under certain conditions of light, even in the adult. The beauty of a lion's skin depends almost entirely upon the degree of development and darkness of the mane; and it is a somewhat curious fact that this magnificent appendage attains larger and finer proportions in menagerie specimens than in wild animals, this being especially the case with regard to its extent on the under surface of the body. Still, captive animals lack that glossiness of mane which forms such a striking feature of the lion in its native haunts. That black-maned and yellow-maned lions belong to one and the same species, is, we presume, as well known as that there is no specific distinction between the African and the Asiatic lion. Black-maned skins are by far the most valuable. We are not aware of any instance of either black or white lions. With the puma the case is, however, different, black specimens being far from uncommon.

The skins of the ordinary Indian tiger are not of much value, but those of the long-haired and somewhat pale-coloured variety from Siberia and Mongolia command a much higher price. Turkestan tiger skins are also held in considerable estimation. Of the Siberian and Mongolian race, one hundred and thirty-five skins are said to have been imported into England in 1891. The scarcest and most beautiful variety is the white or buff tiger, in which the stripes are generally dark brown, although rarely dark drab.

In the pellage of the leopard, or panther (*Felis pardus*), there is even greater variation than in the tiger; this variation showing itself not only in regard to the size and form of the dark rosettes, but also in the length of the hair. African skins are nearly always distinguishable from Oriental; and whereas in Oriental countries a black variety is by no means uncommon, in Africa we only meet with races in which the rosettes on the back are agglomerated into a number of small spots, and the general tint of the fur is darker than usual. A few thousand skins of ordinary leopards annually find their way into the London market. In addition to being used as rugs, leopard skins are manufactured into trappings for the chargers of the officers and bandsmen of some of the British cavalry regiments, as well as for the aprons of the drummers of the infantry. By the Kaffirs, who prepare them in a remarkably excellent manner, they are used as karosses, or cloaks. In a variety of the leopard from China, described under the name of *F. fontanieri*, the fur is much longer and more woolly than in the ordinary form, while the dark spots of the rosettes tend to coalesce into more or less complete rings, recalling those of the jaguar, although the central dark spot of the latter is wanting. The ground colour is unusually light, and the tail very long and bushy. Another variety of the leopard (*F. tulliana*), with still longer and lighter-coloured fur, is an inhabitant of Persia.

Far handsomer than either of the two latter is, however, the snow leopard, or ounce (*F. uncia*), of the highlands of Central Asia, whose pellage excels in beauty that of all other members of the cat tribe. As shown in the plate accompanying an article on the coloration of animals published in the January (1895) Number of Knowledge, the spots form large interrupted rings or rosettes of irregular shape, and are superior in size to those of the typical form of the leopard. The ground colour is white, the entire fur very long (sometimes as much as two inches in length), and the bushy tail, which tapers but slightly, is nearly three-quarters the length of the head and body. Comparatively few skins of this splendid feline reach the English market.



The Ocelot.

The last of the larger members of the genus *Felis* is the American jaguar (*F. uncia*), readily characterized by the dark markings taking the form of nearly complete rings, with one or more black spots in the centre; the ground colour being some shade of tawny or orange. A black variety is not very uncommon.

In marked contrast to the wild species of true cats is the importance of the domestic cat as a fur producer, the number of skins annually used in the trade amounting to many thousands. The colours of the European races are too well known to need mention; and although to our mind dark tabby is by far the handsomest of all, pure black skins are those commanding the highest price.

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More important than all other members of the family are the lynxes, the beautifully spotted or uniformly tawny skins being employed largely as what may be called personal fur—that is, fur used in dress. Of the number of species of true lynxes—that is, those in which the tail is very short, while the ears are each surmounted by a pencil of long hairs—there is much difference of opinion among naturalists. It will, however, suffice for our present purpose to say that there is the European lynx (*F. lynx*), which ranges over Northern Europe and Asia, and the closely allied North American lynx (*F. canadiensis*); while there is a more Southern American type termed the red lynx (*F. rufa*), and likewise a South European form known as the pardine lynx (*F. pardina*). Of the European lynxes it does not appear that many skins come into the market. On the other hand, American pelts form a very large item in the trade, the number sold yearly by the Hudson Bay Company usually varying between eight thousand and forty thousand, although in 1887 as many as seventy thousand were disposed of. Lynx fur may be used either of the natural colour, or dyed black, brown, "blue," or silvered. The longest fur is that on the under surface of the body; this being employed for boas, muffs, and trimmings. Lynx fur dyed brown is also the material employed in the busbies of the officers of the British Hussar regiments. Usually only the long winter fur shows the small black spots, the summer coat being short and uniformly coloured. Less common and of inferior value are the skins of the American red lynx. The bulk of this fur is stated to be exported to Eastern Europe. Of still less value is the skin of the uniformly red and longer tailed caracal of Africa, India, and Persia.

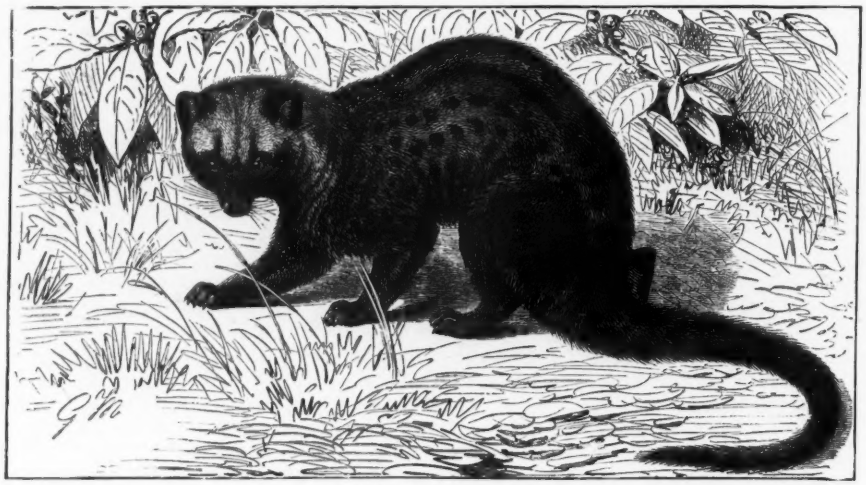
Of the hunting leopard, or, as it is commonly called, chita (*Cynælurus jubatus*), the black-spotted skins too seldom come into the market to be of any importance. This animal, which is one of the few species of carnivora common to India and Africa, is separated from the genus *Felis* on account of the claws being only partially retractile. Unlike those of the true leopards and jaguar, the black spots on the fur are solid, instead of forming rosettes with light centres.

The various species of the civet family (*Viverridæ*) occupy an unimportant position among the list of fur producers, the pellage being generally harsh, while many of the species are comparatively scarce animals. Of the African civet (*Viverra civetta*), not more than fifty skins are annually imported into this country.

The Indian species (*V. zibetha*), which has a nearly similar grey fur, marked with black streaks and blotches, seems to be still rarer. Much the same applies to the different species of the genets (*Genetta*), all of which have short, harsh fur. At a time when "pointing" furs (that is, introducing white-tipped hairs) was in fashion, there was some demand for the pellage of the Egyptian mungoose (*Herpestes ichneumon*). Even now a few hundred skins are imported.

Passing on to the monkey tribe (*Primates*), we find that all the skins used in the fur trade are obtained from various species of the Old World family *Cereopitheridæ*, not a single one of the numerous species of South American monkeys being even mentioned in commercial lists.

The species that yields the greater quantity of the pelts used in the fur trade seems to be the West African white-thighed thumbless monkey (*Colobus vellerosus*), which is abundant on the Gold Coast, and has the body clothed with a mantle of silky black hair measuring from two to four inches in length. Of this (and perhaps some allied) species as many as ninety thousand skins are annually brought to the London market. Considerable difference is stated to exist in regard to the texture of the fur of skins from different localities, which suggests that more than one species are included under the name of "black monkey." They are mostly brought down from the interior by native convoys, and exchanged at the coast for British produce. A large proportion find their way to Germany, although some are exported to Italy and America.



The Malay Palm Civet.

Most valuable of all are the skins of the beautiful guereza monkey (*C. guereza*) of Abyssinia and East Africa; a species characterized by the flowing mantle of elongated silky white hair depending from the black back down the flanks and hind-quarters.

Under the title of "common monkey" are imported skins of various species of another African genus (*Cercopithecus*), the most numerous of these forms being probably Campbell's guenon (*C. campbelli*) of West Africa. The importations of other African skins are too unimportant for mention; and we may conclude this section by adding that of the long-haired grey langur (*Semnopithecus schirtaceus*) of the Himalaya, from two to three hundred skins are annually received into this country.

THE HISTORY OF THE GREAT LAKES AND NIAGARA.

By ANDREW J. HERBERTSON.

THE problem of the origin of the Great Lakes and Niagara has always been an interesting one, and various theories have been put forward to explain it. Dr. J. W. Spencer, of the Geological Survey of the Great Lakes, has recently published a set of papers in which he attempts to reconstruct the past history of the Great Lake Region of America.*

Dr. Spencer believes that between the middle Miocene and early Pleistocene periods the region stood three thousand, perhaps even five thousand or six thousand, feet higher than at present. In support of this he appeals to the evidence of soundings round the American coasts, which reveal the existence of what appear to be ancient river channels. For instance, were the water to sink six hundred feet below its present level the banks to the south of Newfoundland and Nova Scotia would be dry land; but this would be traversed by a deep fjord over three thousand feet deep where it joined the sea, whose depth near its mouth would be five thousand feet. This channel, sixty miles wide at its mouth, follows for over eight hundred miles the bed of the present St. Lawrence River, growing narrower and shallower as it projects inland. Dr. Spencer supposes that previous to the existence of the present lake basins the continent was much higher, and was drained by a great river, which he names the Laurentian River, which excavated this deep channel. The depths of the various lakes afford corroborative evidence, the floors of Ontario and Superior being almost five hundred feet below the present sea-level, that of Michigan three hundred feet, and of Huron one hundred and fifty feet. The soundings of the lakes and borings in various regions reveal the ancient beds of this Laurentian River and its tributaries. Lake Michigan was drained by two rivers, one in the northern basin which flowed by the present outlet to Lake Huron, in the middle of which it was joined by a tributary running from the southern basin of Lake Michigan, across the present State of Michigan, and through Saginaw Bay. The united streams did not flow southwards towards Lake Erie, but first north-westwards to the present Georgian Bay, then south-eastwards near its western shore, and by Lake Simcoe, turning to the eastwards at a point in Lake Ontario nearer the southern than the northern shore, and thence to the sea by the present course. The Lake Erie basin was drained by another tributary which turned northwards by the Grand River and Dundas Valleys, and curved eastwards again at the western end of Lake Ontario, joining the Laurentian main stream at its bend opposite the mouth of the present Niagara River.

This river and its tributaries had eroded the region and formed broad valleys just before the Pleistocene period, and during that period, and particularly towards its end, parts of the old valley were gradually blocked. This blocking of the valley may have been due to the accumulation of glacial drift at some places, but Dr. Spencer believes that terrestrial warpings are a more important factor, and that these to a certain extent are measurable. The absence of glacial markings in the direction of the axis of the lakes goes to prove that they have not been hollowed out by ice.

Round the Great Lakes are found traces of terraces composed of waterworn pebbles, the result of the action of waves or of currents. These Dr. Spencer has examined and surveyed, and concludes that they are of marine origin at a time when there was a depression of the surface to over two thousand feet below its present level. He does not discuss the theory that they may have formed the shores of lakes retained by moraines, but he points out that glacial lakes retained by ice are neither large enough nor sufficiently long lived to account for such beaches. The depression of the continent at the time of the newest till is no more impossible than the generally admitted elevation of the pre-Pleistocene period, but the discontinuity of the terraces and the absence of salt-water deposits are difficulties in the way of the theory of their marine origin. The first of these objections is met by the answer that these terraces have not yet been perfectly explored, that subsequent terrestrial movements may have deformed them, and that erosive and other agents have been at work modifying the topographical features. As to marine deposits, these are found at a height of five hundred and twenty feet, but their absence at higher levels is not evidence of the non-marine character of these old shores, since there are many marine beaches in which no fossils are found.

When the depression of the land was greatest the region of the Great Lakes was then a huge ocean gulf, whose shores formed one of the raised beaches Dr. Spencer has surveyed. It is possible that at times the narrower parts of the gulf may have been filled up from giant glaciers, but these ice barriers could not retain a vast volume of water for any lengthened time.

But a close examination of the raised beaches leads to other conclusions. They do not lie parallel to the present water surface of the Great Lakes, but are usually higher above the lake level in the east than in the west, in the north than in the south. This affords important evidence of terrestrial deformation having taken place since the formation of these beaches; and these alterations of levels have resulted in the formation of the Great Lakes.

The first uplift seems to have taken place in the region to the south-east of the present Lake Huron, and when the land had risen one hundred and fifty feet the upper waters of the original gulf, covering Lakes Superior, Michigan, Huron, and Georgia, were separated from the lower waters which extended over the present Lakes Ontario and Erie. This great lake was at first joined to the sea by a broad strait covering the present Lake Nipissing and the Ottawa Valley.

The next event was the isolation of Lake Erie, and at first its waters, too, flowed to the Ontario Gulf without any perceptible fall. The upward movement of the land continued until there were three hundred feet of difference between the levels of the gulf and the lake, and the Niagara Falls came into existence. But the water falling over them was only that of Lake Erie, for the overflow of the upper lake still took place by the Ottawa Valley. This was the time when the beach round Lake Ontario (which Dr. Spencer calls the Iroquois) was formed approximately at the sea-level, and must have been after the uppermost drift was deposited, as it rests on mud covering the till. This beach is three hundred and sixty-three feet above the sea (one hundred and sixteen above the lake) at the western end of the lake, but it rises especially in the north, and at the east end it is six hundred feet higher than at the west end.

As the uplift continued more rapidly in the east than in the west the communication with the sea was gradually closed, save by the present channel of the St. Lawrence, and Lake Ontario was formed. The rising of the land

* "The Duration of Niagara Falls and the History of the Great Lakes." By J. W. Spencer, A.M., Ph.D., F.G.S. Second Edition. 1895. (Albany: The Commissioners of the N.Y. State Reservation at Niagara.)

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went on, with some short pauses, until the level of the waters ultimately reached eighty feet below the present surface at the mouth of the Niagara Gorge, when the Niagara River was about four miles longer than now.

The Niagara River, which had first been a strait joining Lake Erie to the Ontarian Gulf, became a wide, shallow, rapid stream; and then, as the waters of the lower lake subsided, its bed narrowed and its fall increased to four hundred and twenty feet. But the river was soon greatly enlarged. The land was rising to the north of Ontario as well, and ultimately the outlet from Lake Huron to the Ottawa Valley was blocked, and the surplus waters of the three greatest lakes flowed by their present course to Lake Erie, and thence by the Niagara River.

With the continued rise of the land, especially towards the east of Ontario, the water-level rose until it attained its present elevation, and the fall of the river between the two lakes was reduced to the present three hundred and twenty-six feet.

Can dates be assigned to these events? The first estimate of the age of Niagara River was given by Ellicott over a century ago at fifty-five thousand four hundred and forty years; Bakewell, in 1830, gave twelve thousand; Lyell's estimate of thirty-five thousand was accepted for many years after 1841; but recent writers, using the mean rate of recession during forty-eight years as determined by surveys, make the value about nine thousand years.

Dr. Spencer has made a new and careful computation of the age of the Niagara River and Falls. He shows that the recent estimates have not taken into account the various changes that have occurred in the fall and volume of the river. His calculations result in a value nearly that of Lyell's. Dr. Spencer believes the Niagara River was formed thirty-two thousand years ago, and that a thousand years later the falls were in existence. For seventeen thousand two hundred years their height was about two hundred feet; thereafter the water fell four hundred and twenty feet. Seven thousand eight hundred years ago the drainage of Lakes Superior, Michigan, and Huron first flowed through the Niagara Gorge, and three thousand years ago the waters rose in Lake Ontario until the level reached that of to-day. The falls, then, are thirty-one thousand years old. This estimate, calculated from the rate of erosion, is confirmed by another made from the terrestrial movements.

Two deductions may be given—one as to the past, the other concerning the future.

The lakes came into existence after the glacial epoch, and Niagara after the lakes; and calculations based on the mean rate of rise of the beaches in the earlier period of the lakes' history show "that the close of the ice age may safely be placed at fifty thousand years ago."

As to the future. "With the present rate of calculated terrestrial uplift in the Niagara district, and the rate of recession of the falls continued or even doubled, before the cataract shall have reached the Devonian escarpment at Buffalo, that limestone barrier shall have been raised so high as to turn the waters of the upper lakes into the Mississippi drainage by way of Chicago. An elevation of sixty feet at the outlet of Lake Erie would bring the rocky floor of the channel as high as the Chicago divide, and an elevation of seventy feet would completely divert the drainage. This would require five thousand to six thousand years at the estimated rate of terrestrial elevation."

"A Crocodile Mummy."—The reference to the reign of Ptolemy Philadelphus as B.C. 330, at page 211 of the September Number, should have read "B.C. 280."

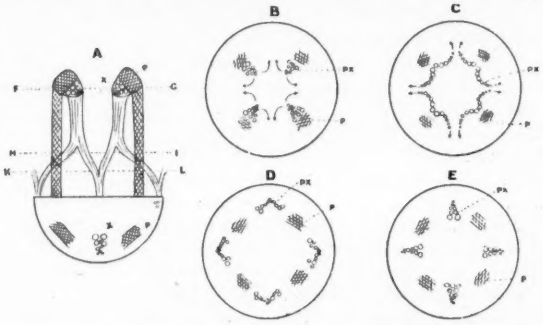
THE TRANSITION FROM STEM TO ROOT.

By A. Maslen.

WHILST all students of botany may be presumed to be sufficiently acquainted with the minuter structure of the Phanerogamic members, and to know the fundamental anatomical distinctions between the stem and its direct prolongation downwards, the root, there still exists a region, viz., the hypocotyl—in which the actual transition takes place—about which their knowledge is perfectly *nil*. For information on this particular the student may search in vain in the ordinary smaller botanical text-books, excepting only the admirable little book of Dr. Scott ("Structural Botany." London: Adam & Charles Black, 1894), in which will be found a very clear though necessarily short account of the transition as it takes place in the Wallflower.

It seems opportune, therefore, now that a considerable amount of work has been done on this neglected subject, although very much still remains to be done, to endeavour to give a necessarily short but succinct account of our present knowledge.

It may, perhaps, conduce to clearness if we give just a brief *résumé* of the structure of a stem and root of a typical Dicotyledon or Gymnosperm. In a transverse section of such a stem we see around the pith an interrupted zone of vascular bundles, each of which consists of phloëm lying externally, *i.e.*, next the cortex, followed inwards by the xylem or wood, between which and the phloëm is a band of actively dividing cells—the cambium. Such an arrangement, in which the xylem and phloëm groups both lie on one and the same radius, constitutes what is known as a collateral bundle. But a point of great anatomical importance has been omitted, namely,



Type I.—A, Diagram showing longitudinal course of bundles through hypocotyl. P The phloëm. X The xylem (smaller elements the proto-xylem.) B, C, D, E, Diagrammatic transverse sections through the hypocotyl showing transition from stem to root structure. P The phloëm. P X The proto-xylem. B, Through F G. C, Through H I. D, Through K L. E, Root structure. (The arrows indicate the way in which the rotation of the proto-xylem takes place).

that in the stem the first-formed xylem, or proto-xylem, which consists of smaller elements than either the later-formed primary xylem or the secondary xylem formed by the activity of the cambium, and which, moreover, is the only part of the xylem having annular or spiral thickening, *is always internal, i.e., next the pith.*

If, now, we turn to the root, differences are at once evident. If we examine a sufficiently young root (before secondary thickening has set in) we shall see that each bundle consists not of xylem and phloëm, but of only one of these constituents, and that, moreover, the xylem does

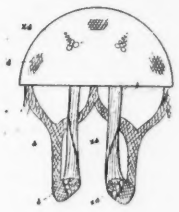
not lie just inside a phloëm group as in the stem, but the two are arranged on alternate radii; hence such an arrangement of the bundles, which is typical of roots, is known as *radial*. Moreover, here the proto-xylem or oldest wood is *formed at the outside of the primary xylem*.

It is this position of the proto-xylem with reference to the primary xylem which constitutes the most valuable criterion in distinguishing between sections of stem and root—by no means an easy matter, especially after a deal of secondary thickening has taken place.

It is clear that the physiological necessities of the case demand perfect continuity of the corresponding tissues of stem and root, and we will now consider the structure of that part of the axis between the root and cotyledons, viz.: the hypocotyledonary stem or hypocotyl.

Transition from stem to root.—The work at present done enables us to distinguish at least four good leading types, which we will now proceed to consider in order—taking the simpler modes first:—

Type I. Ex Common Fumitory (*Fumaria officinalis*), Pinus, etc. Here the leaf-traces, as they come in from the cotyledons, place themselves in pairs, each pair lying tangentially across the stem with the proto-xylems facing one another. The phloëm (bast) then goes down into the root unchanged in position, whilst the xylem of each bundle divides into two portions, which diverge and ultimately coalesce with the corresponding segments of the xylem of its neighbours. Meanwhile *the proto-xylems have rotated* so as to be, not at the inner limit of the bundle, but at the most peripheral part of the primary xylem of the root.

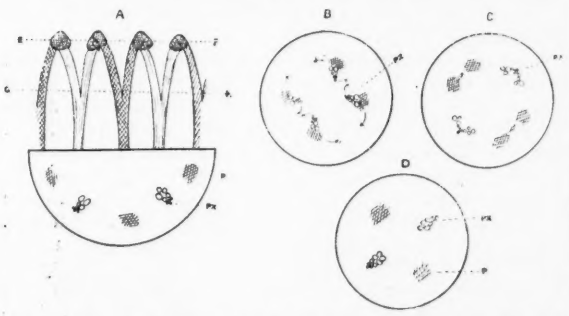


Type II.—Diagram showing longitudinal course of the bundles through the hypocotyl. P The phloëm. P X The proto-xylem.

In this way we get the transition from the nearly collateral bundles at the upper part to the typically radial arrangement of the bundles at the lower region of the hypocotyl, *i.e.*, where they enter the root.

Type II. Ex Biota (*Cupressineæ*), Medicago, etc. Here we have the converse case to the foregoing. It is the xylem which goes down unaltered except for the rotation of the proto-xylem, whilst the phloëm divides in a manner similar to the xylem of Type I.

Type III. Ex Phaseolus, Cheiranthus (wallflower), etc.



Type III.—A, Diagram showing longitudinal course of the bundles through the hypocotyl. P The phloëm. P X The proto-xylem. B, C, D, Diagrammatic transverse sections (four bundles only are shown). B, Through E F. C, Through G H. D, Root structure.

This is a common type where there occur a relatively large number of leaf-traces; and whereas in Types I. and II. there are as many bundles in the root as there are separate groups of xylem and phloëm in the upper part of the hypocotyl, here there are only half as many.

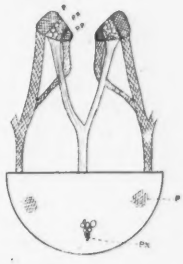
The two xylem strands of each pair fuse, whilst the phloëm strands of each pair diverge more and more from each other until ultimately they coalesce with the adjacent phloëm strands belonging to the pairs right and left of them. Meanwhile, the proto-xylem has rotated to the periphery of the xylem mass.

In the root, therefore, each xylem mass is the direct prolongation downwards of the two xylems of one pair, whilst each phloëm mass is the continuation of the phloëm of the adjacent bundles belonging to *two* pairs.

If we consider a series of transverse sections—in *Phaseolus multiflorus*—passing through the lower part of the stem, the hypocotyl, and the upper portion of the root, we see the following consecutive changes. At the base of the young stem we have typical collateral leaf-trace bundles. Lower, the cotyledonary bundles enter and join with the leaf-trace bundles, so that immediately below the insertion of the cotyledons we have eight vascular bundles in pairs; but in each pair the proto-xylem groups are not directed straight inwards, but are turned towards one another. Moreover, the primary xylem is not directly opposite the phloëm, but lies so that the two groups of xylem belonging to each pair are nearer to each other than are the corresponding phloëm groups. A section still lower will show that the xylem groups approach one another, and ultimately fuse at the same time that their proto-xylem turns more and more towards the outside.

Meanwhile the phloëm strands have undergone a similar change in the reverse direction. A section still lower will show that the xylem has closed up, the proto-xylem is directed straight outwards, and we have reached the typical root structure.

Type IV. Convolvulus, etc. Here matters are somewhat complicated by the structure of the vascular bundles, which are bi-collateral, *i.e.*, each bundle has two groups of phloëm, one being situated on the outside of the xylem and a second on its inner side. We have a similar transition to the *Phaseolus* type, with the internal phloëm superadded.



Type IV.—Diagram showing longitudinal course of the bundles through the hypocotyl. P External phloëm. P P Internal phloëm. P X The proto-xylem.

The internal phloëm joins the phloëm on the outer side of the bundle, passing in between the converging xylem groups.

It is evident that this phloëm must cross the cambium, but it is not at all clear how this is effected: whether it passes bodily through (which is improbable), or whether it is continuous through the cambium only in a metaphysical sense, *i.e.*, in the sense that a medullary ray is continuous through it.

In all the foregoing types, therefore, in spite of the different arrangement, the xylem and phloëm of the main root are the direct downward continuation of the corresponding tissues of the stem, and this continuity is also preserved in the case of the pericycle as well as the endodermis and other cortical tissues. The only abrupt change is that of the epidermis of the stem to the piliferous layer of the root, *i.e.*, the layer which produces the root-hairs.

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PHILOLOGICAL NOTE ON THE CONSTELLATIONS URSA MAJOR AND URSA MINOR.

By John H. Reynolds.

THERE is probably no constellation in the heavens which has excited such general interest amongst all nations and in all ages as the Great Bear. Its seven principal stars, nearly equal in magnitude, seem so conspicuously connected to the eye that even primeval man must have been impressed with their very definite appearance.* It is mentioned in the Rig Veda, perhaps the oldest piece of Aryan literature extant; it is recorded in Chaldæan and Egyptian monuments; Homer makes mention of it in the "Iliad" when describing the shield of Achilles:—

> "The Pleiades, the Hyades, the might
> Of huge Orion: with her Arctos called.
> Known also by the people's name, the Wain,
> That spins around the Pole."

And it is noticed in the works of Hesiod, Aratus, Ovid, Virgil, and Dante.

Its general name in Europe at the present time is "The Great Bear," which is simply a translation of the Latin "Ursa Major." However, it goes by several other names besides. It is known in the British Isles as "The Plough," "The Waggon and Horses," and "Charles's Wain"; in France as "Le Grand Chariot"; in America—that country of vulgarisms—as "The Great Dipper," *i.e.*, "ladle"; while the North American Indians call it "Paukimawaw," which is said to mean "Ye stand alone."

Its likeness to a plough or waggon is very easily discernible, and it is only natural that we should find this idea generally adopted in all countries, ancient and modern. The Romans grouped the Great and Little Bear together and called them "Triones," literally "The Ploughing Oxen." The Great Bear by itself was called "Septentriones," or "The Seven Ploughing Oxen," the idea contained in this phrase being that the constellation known to us as "The Little Bear" was a plough, drawn by seven oxen, which were represented by the seven bright stars of the Great Bear. It was known to the Greeks also as ἅμαξα, the "Waggon" or "Wain." The Greek mariners always sailed by the Great Bear, which they called ἑλικη, "The Swinger," as it appeared to swing round the Pole once every twenty-four hours. The Phœnicians, on the other hand, used the Little Bear, which received from them the name of "Cynosura" ("The Dog's Tail").

The ancient Egyptians, fancying they saw a resemblance to the haunch of an ox, called it "Maskhait," and depicted it as the detached leg, shoulder, and head of an ox; one of their "nomes" or provinces was named "The Nome of the Haunch" after it.† The Babylonians also had a name for it, but up to the present the constellation has not been satisfactorily identified.

The Latin *ursa* is of course the feminine form of *ursus*, and should be properly translated as "The She-Bear": the Greek word ἄρκτος, when Latinised, became *arctus*, contracted into *ursus*, and the idea of calling it "The Bear" came originally from the Greeks.

How it came to be called "The Bear" is a very interesting question. Virgil calls it "Lycaonis Arcton," or "Lycaon's Bear," which is explained by Ovid thus:—Callisto, the daughter of Lycaon, King of Arcadia, being beloved by Jupiter, was metamorphosed into a she-bear by Juno (or Diana), who was jealous of her; whilst in this shape she was killed in the chase, whereupon Jupiter transferred her to the stars. This legend, however, arose after the constellation was called "The Bear," and was invented simply to explain its presence in the sky. It is impossible that the Greeks should first have given it this name from a supposed resemblance to the animal, as they must have known what bears were like well enough not to have credited the animal with such a preposterous length of tail.

The most likely solution is that treated so eloquently in Max Müller's "Science of Languages." In the Rig Veda, before mentioned, there is the following passage:—"The Riksha, which are placed on high, and are seen by night, whither do they go by day?" The root *rich* means "to shine," and *riksha* meant primarily "the shining ones," and was applied to this constellation by the ancient Aryans; but the name *riksha* was also given to the animal with shining eyes and shining glossy hair, *i.e.*, the bear. By a natural confusion of ideas, the constellation itself ultimately became to be known as "The Bear," while the similar arrangement of seven smaller stars near Polaris was termed "The Little Bear." As Max Müller says in the book already referred to:—"The surprise with which many a thoughtful observer has looked at these seven bright stars, wondering why they were ever called 'The Bear,' is removed by reference to the early annals of human speech."

[I do not think it at all impossible that the Great Bear was so named by the ancients from a supposed resemblance to the animal. The distinguishing feature of the bear is its broad, flat feet, and these the celestial Bear certainly possesses in the three remarkable pairs of stars, ι and κ, λ and μ, and ν and ξ. If the name of any animal was to be given to the group, the bear was certainly the most natural to be chosen, in spite of the long tail which Ursa Major has to carry. On the other hand, Max Müller's explanation seems to me a little forced. Surely the ancient Aryans did not know the Polar bear; whilst the brown bear has no special claim to be regarded as "the animal with shining eyes and shining glossy hair."—E. Walter Maunder.]

* Besides this apparent connection there seems to be a real physical one existing, as all the seven stars have been found to have a c.p.m. through space

† This constellation is still known to the Arabs of the Pyramids as "Er-rigl" ("The Haunch").

TOTAL ECLIPSE OF THE SUN.

THE following are the attendant phenomena that were observed during the total eclipse of the sun, occurring August 9th, and seen from the American line s.s. *Ohio*, off Stot Island, on the west coast of Norway, latitude 66° 57′ N., longitude 13° 30′ E.

According to Greenwich mean time, the first contact occurred at 8d. 14hrs. 58min. 22sec., and careful watch was made for the shadow bands. As the black disc of the moon slowly encroached upon the sun, a sombre, yellowish hue spread over the ocean and the hills on the Kunnen promontory near by, and just before totality a bank of grey clouds settled on the top of the hills. At the same instant the temperature fell two degrees, from 53° to 51°, whilst the seagulls flew affrighted from the approaching darkness. In the vicinity of the sun during totality the sky was cloudless, but of a dull greyish hue, and we were fortunate in having a perfect and uninterrupted view of the coronal streamers. A brief second before totality a faint outline of the inner corona could be seen, whilst during totality it was noticeable that the streamers directed from the solar poles were shorter and less brilliant than those extending along the eastern line. Along the western line a streamer reached to a distance equalling apparently three

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SOUTH.

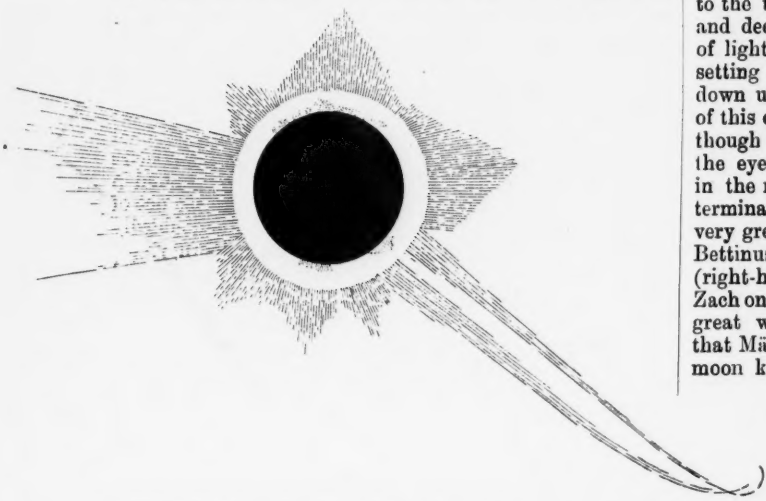
WEST. EAST.

NORTH.

CLAVIUS AND HIS NEIGHBOURS.

From a Photograph taken at the Lick Observatory, Mount Hamilton, California, 1895, October, 9d. 16h. 36m. 15s.–25s. Pacific Standard Time, with the 36-inch Refractor, and Brashear Enlarging Lens. Age of Moon, 21d. 15·5h. Scale, 44 inches to the Moon's Diameter.

times the diameter of the sun. Near the western edge there were two large prominences, whilst only a few smaller ones were to be seen on the eastern edge. Two or three seconds before totality ended, a narrow, dark streak of strong red light made its appearance on the western edge of the moon, and next moment the sun burst forth in a blaze of



glory, and the corona vanished; but that impressive scene, occupying one minute and thirty-five seconds, is one that can never be forgotten. During totality, the planets Mercury, Venus, and Jupiter were plainly to be seen, and some of the well-known constellations. I could not spare the time to get a glimpse of Regulus, but it was seen by Captain Boggs and the chief officer of the ship, and also by some of the passengers. We closely observed the eclipse till the final contact, and within half an hour of totality clouds drifted across the sun resembling the cloud-belts seen upon the planet Jupiter. Just before the last contact the clouds were still drifting in that direction, so that we had to watch most carefully to detect the exact moment of the final contact.

The following are the data of the eclipse, furnished by Captain Boggs and E. Roberts, chief officer, and made according to the ship's chronometer and Greenwich mean time:—

	Days.	Hrs.	Min.	Sec.	
August	8	14	58	22	First contact.
,,	8	15	53	25	Total obscuration began.
,,	8	15	55	00	Total obscuration ended.
,,	8	16	50	03	Last contact.

Mary Proctor.
(Daughter of Richard A. Proctor.)

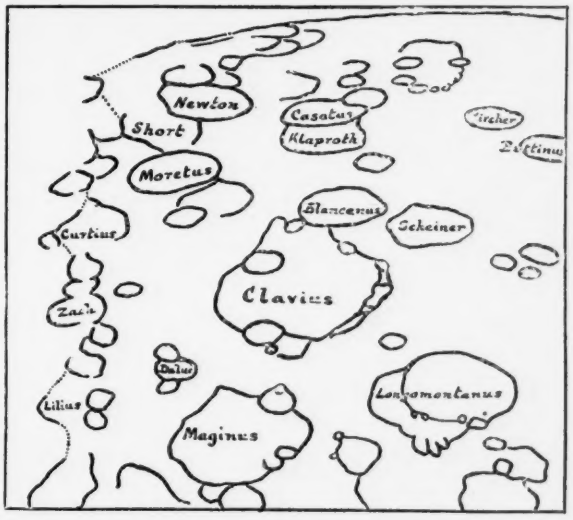
CLAVIUS AND HIS NEIGHBOURS.

By E. Walter Maunder, F.R.A.S.

THE accompanying plate, which exhibits about the one-thirtieth part of the moon's apparent disc on the magnificent scale of forty-four inches to the lunar diameter, is reproduced from a fine photograph taken with the great refractor of the Lick Observatory, and which Prof. E. S. Holden, the director of the Observatory, has most kindly placed at our disposal. It represents sunset on perhaps the most broken and mountainous region of the entire moon, *i.e.*, that which has the great walled plain of Curtius as its centre. In the illuminated portion of the plate we find the giant-walled plain of Clavius, one of the princes of lunar formations, in a region of great walled plains only less striking than itself, some of them, though not equal to it in area, exceeding it in depth.

The region is one which undergoes the most striking change of appearance as the moon's age increases from the eighth to the twenty-third day of the lunation. For these broad and deep plains, so bold and striking, and with contrasts of light and blackness so intense under the rising or the setting sun, vanish almost completely when the sun shines down upon them from their meridian. Some indication of this contrast may be gained from the photograph itself, though it is less pronounced on the sensitive plate than to the eye, and the field here shown to us does not embrace in the main a greater arc than is traversed by the moon's terminator in three days. But even so, the difference is very great between the distinctness of such formations as Bettinus, Longomontanus, and Wilhelm I., on the east (right-hand) side of the plate, and Curtius, Moretus, and Zach on the west (left-hand). The disappearance of these great walled plains is so complete under a high sun that Mädler's words have passed into a proverb: "The full moon knows no Maginus." At such times the feature of the district is not the massive ramparts of the broad plains, nor the rugged and intricate mountain lands interlaced between them, but the long bright streaks radiating from Tycho—which lies just outside the present plate to the north—and extending to the very limb.

With such an infinite complexity of detail, and with such entire and rapid change of presentment, the region of our plate offers a fine field for the selenographical student. The careful and thorough scrutiny of each of the numerous formations here presented to us under all the variations of libration and illumination, would demand the fullest efforts of a large corps of observers. Under such circum-



Key to Plate. Clavius and his Neighbours.

stances it would be idle to attempt here anything like a full description of the entire district. A brief mention of the principal objects will suffice.

Clavius, by far the largest member of the group, has an area about equal to that of the six northern counties of England, and its wall, for the most part, considerably

exceeds two miles in height, whilst two of its peaks would much overtop Mont Blanc. Two ring plains, themselves of great extent, occupy the south-western and north-western portions of the wall, and a chain of important but smaller ring plains follow a well-marked curve across the centre of the great plain. An infinity of minor details will reveal themselves to the student either at the telescope or upon examination of the photograph, and repay his scrutiny; whilst, as a mere spectacle, from its vast extent and the loftiness of its rampart Clavius is an object of extreme beauty when seen on either terminator.

The next in importance to Clavius is Maginus, the border of which is an object of the most complicated structure. As seen in the photograph, the western rampart appears as complete as that of any of the neighbouring plains, whilst it is much loftier. The eastern wall is honeycombed with craters and small ring plains of great depth. The region to the north-west of Clavius and south-east of Maginus is a mountain labyrinth of the greatest intricacy.

Third of the walled plains before us is Longomontanus, with an area about that of Yorkshire. This, from its higher illumination, appears a much shallower formation than the two already mentioned, and indeed its rampart is not quite so high; still, its principal peak, which is quite clearly seen on the photograph, rises to a height above the interior equal to that of Mont Rosa.

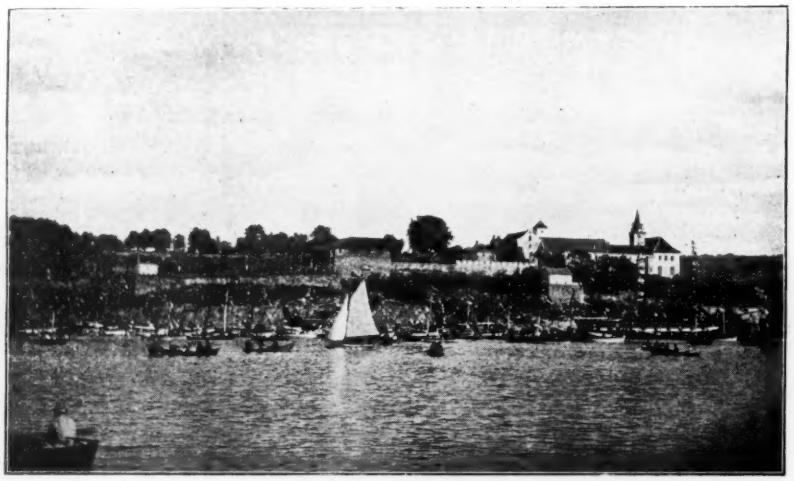
Of the smaller walled plains, Klaproth may be readily distinguished on the photograph by its smooth floor; Casatus, its companion, by a deep central ring plain and by a rampart of unusual height, its highest peak, which the photograph distinctly shows at the western angle, attaining a height of over four miles. Moving westward from Casatus we come to Newton, perhaps the deepest walled plain on the moon. On the western side of this, a bright projection is seen in the plate, marking the place of the chief peak of Newton, one of the very loftiest that the entire lunar surface presents. Moretus is distinguished by its superb central mountain, according to Beer and Mädler the highest central mountain on the whole moon.

Of the other formations, the most considerable are Scheiner and Blancanus, to the south of Clavius, and Curtius on the terminator. The northern wall still retains in its principal peaks the sunlight which has passed from the interior of the plain, for it towers some sixteen thousand feet high, and in its loftiest peak it rivals even the pinnacle of Casatus. Kircher, near the eastern edge of the plate, reveals its character very plainly as a very deep ring plain with a smooth floor. The south pole lies in the shadow where the limb appears broken at the top of the picture near the terminator. Lastly, if we follow the terminator to an inch and a half from the foot of the plate, we find the sunlight withdrawing itself from the ring plain of Lilius, an object which just came into the field of our last lunar reproduction, namely, that which appeared in Knowledge for April, 1896.

THE RECEPTION OF DR. NANSEN AT CHRISTIANIA.

WHEN the news of Dr. Nansen's return with Lieutenant Johansen first reached Christiania it was scarcely believed. When the report was confirmed, however, and we read the account of his marvellous journey, the universal excitement and enthusiasm throughout the country were quite unprecedented. The news of the arrival of the *Fram*, with all on board well, a week or so later, of course added to the fire already kindled, and all Norway seemed to go mad. Preparations were soon begun for a national reception at Christiania. This took place, as the readers of Knowledge will remember, on September 9th, and a few details of the fête by an eye-witness may not be out of place here, since they concern one who has undoubtedly immensely benefited science by his wonderful journey.

It was a glorious sight that met our eyes as we steamed into the harbour in our little launch. Ship after ship,



The Harbour before the arrival of the *Fram*.

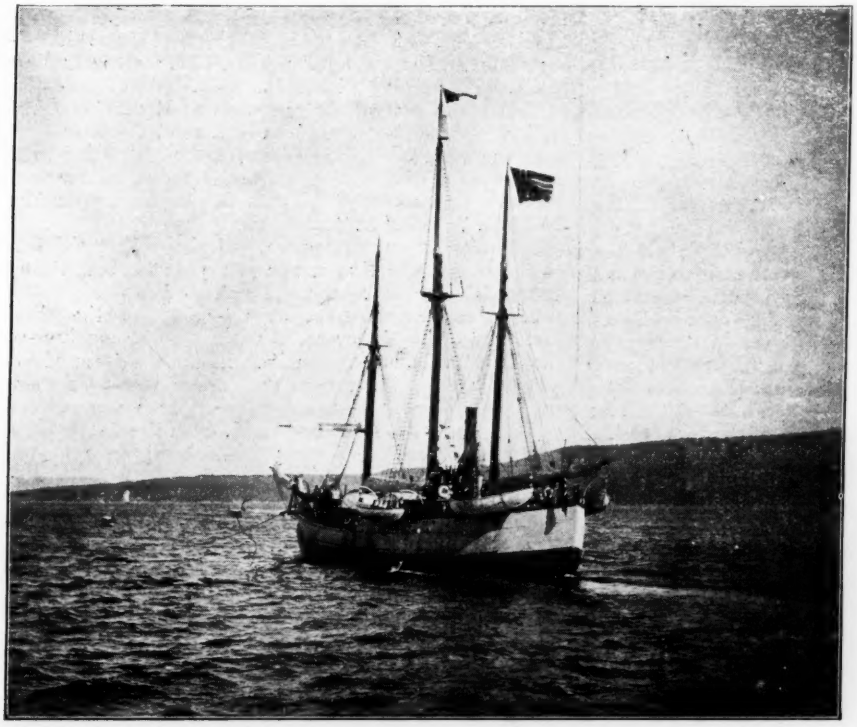
decked from bow to stern with flags, was taking up her place in the double line which was to steam up the fjord to meet the *Fram*. The ice breakers with their broad beams led the way, and these were followed in long lines, almost as far as the eye could see, by steamers of every sort and shape, each one having an assigned position according to her size. Glancing toward the shore one could see hundreds and hundreds of sailing boats and rowing boats—a mass of flags and bunting.

At last we caught sight of some gunboats, and then the *Fram*, conspicuous by her tall mast and white crow's-nest, appeared from behind a distant point. Salute after salute was fired from fort and gunboat, as she passed up between the lines, while every steamer dipped her flag, and every man cheered until he was hoarse.

Then the boats turned and followed the *Fram* into harbour. Arrived there, Nansen and his brave companions were rowed ashore by a crew from the training ship. The reception on shore was quite as grand in its way as the reception on the sea. Speeches were made on the quay, and again at the University, as these thirteen men drove through the densely packed streets to the castle. The whole town was decorated in the most gorgeous fashion.

Such universal enthusiasm would indeed be difficult to match; the sharp hurrahs and the clapping of hands of the Norwegians, and every now and then, high above the general clamour, the "hip, hip, hurrahs" of a party of Englishmen, deafened all around.

At length the procession arrived at the palace, and while Nansen and his comrades were being received by the King, a huge, expectant crowd gathered below. They were not to be denied another chance of seeing their champions. Continual cheering and clapping of hands went on, while one man cried out "All hands on deck." Almost immediately, as if in response, the King in person led out Nansen and Sverdrup to the balcony; then the rest of the expedition, and once more Nansen—this time alone—and never did the enthusiasm abate.

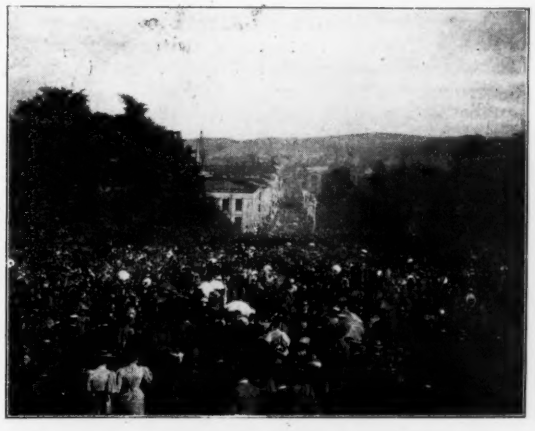


The *Fram* being towed into Christiania Harbour.

A great state dinner followed, and in the evening perhaps the most picturesque sight of all, though witnessed by comparatively few. Dr. Nansen lives in an elegant little house overlooking the fjord at Lysaker, some four miles from Christiania. Along the whole route, as he drove home, torches and coloured lights were blazing. Arrived at his house a pretty scene was enacted. In answer to the cheers of the crowd, Nansen came out, and with much feeling exclaimed, "Many thanks—many thanks to everybody." His fine figure silhouetted in the doorway, and a glimpse of those within preparing his coffee, formed a vivid contrast of peaceful home life with the hardships and dangers which he had experienced during the past three years.

Two days afterwards Lieutenant Johansen very kindly showed us over the *Fram*. It seems incredible that any boat could stand—at all events without injury—such pressure and knocking about as this wonderful boat has sustained. Yet she appears perfectly sound, and the only evidence of the rough usage by the ice is the paintless condition of her hull.

Getting on board, we were first attracted by some shaggy-coated, handsome sledge dogs, born up in the Arctic regions, with their mother, who is the only survivor of all the dogs taken out. Then we went down into the fore hold, and Johansen showed us the kayaks, sledges, and ski used by himself and Nansen on their memorable journey. A greasy dirty pot, too, blackened and covered with blubber, in which they boiled their soup. He also showed us their sleeping bag, made out of a Polar bear's skin, with the fur inside, remarking as he drew it out, "Many is the good time Nansen and I have had in that!" and one could well imagine it after toiling and straining all day. The sledges bore many traces of the hard work they had been put to, being tied and patched all over with consummate care. On their journey across the ice the sledges bore the kayaks, while the kayaks bore the sledges across the water, and one wondered that such frail craft could take such a load unless in the calmest sea. We visited the tiny saloon and cabins, and examined the rifles and other equipments, all of which had their interest when one considered that the fate, maybe, of both ship and crew depended on every little thing going right. A American organ in the saloon was not the least interesting



The Crowds in the Streets after the Procession.

object, and that it had been much used, and by no tender hands, to cheer those on board in the long Arctic night, was apparent.

In conclusion, let us heartily congratulate Dr. Nansen and his brave companions on their wonderful success, not only in reaching the furthest point north ever before attained by man, but in bringing back ship and crew safe and well, and with three years' provisions still on board.

H. F. W.

Letters.

[The Editors do not hold themselves responsible for the opinions or statements of correspondents.]

HOW TO OBSERVE THE INTERIOR OF ONE'S OWN EYES.

To the Editors of KNOWLEDGE.

SIRS,—In KNOWLEDGE for May, 1894, Vol. XVII., p. 117, a letter appeared describing how a man may see a cataract on his own eye by looking through a pinhole in a card held close to the eye. But there are many other and some better methods of seeing this and any other markings there may be, either in, on, or in front of the eye; eyelashes will be seen if they are allowed to come in the way, or drops of water on the surface, and muscæ volitantes are very clearly seen. Some methods of viewing the marks have one advantage, and others have another. One of the best is by looking at a bright star or distant lamp through a telescope, using a high power eyepiece very greatly out of focus. Instead of a star, the sun or moon may be used, especially if the aperture of the telescope be reduced to very small dimensions. Or an eyepiece alone, without the telescope, but looking through a pinhole diaphragm. Or one may look through a microscope at a concave reflector turned to the sky, the reflector being covered by a piece of paper with a small hole in it. Any point of light close to the eye will do, such as the sun's reflection in a small drop of water.

In some of these ways the marks may be seen quite sharply defined and very highly magnified; but they are necessarily bordered by diffraction lines and rings. By moving the eye, one can distinguish by the changing positions and apparent size of the marks the various depths from the surface at which they are situated; and by suitable experiments one can measure these distances when the focal length of the lens used is known. I thus calculate—without allowing for the refraction of the eye—that in my own case the principal marks are at a depth of about 0·26 inch from the surface, while the next in importance are at about 0·10 inch. These measurements are only rough, but I have no doubt it would be possible to make them with a high degree of accuracy. If the refraction of the eye were allowed for, the distance of the marks from the surface would come out greater.

I have made an estimate of the degree of magnification obtained by some of the methods named. One of the marks on the lens of the eye was found to be 0·017 inch across; and this was so magnified as to subtend an angle of seventeen degrees or more. If such an object were viewed at a distance of ten inches, which is considered a normal distance, its diameter would be six minutes of arc. Its magnification to a diameter of seventeen degrees is therefore equivalent to viewing it with a magnifying power of one hundred and seventy. The advantage of high magnification is partly neutralized by the difficulty of keeping one's eye steady, and the consequent great mobility of the image; also by the outlines being less sharp.

It is very interesting to observe the changes taking place in one's eyes from time to time, and to note how extremely slow most of such changes are. T. W. BACKHOUSE.

VARIABLE STARS.

To the Editors of KNOWLEDGE.

SIRS,—Chandler's Third Catalogue of variable stars has appeared, and is an invaluable document involving an immense amount of work and judicial calmness, both of which have been bestowed upon it to the great credit and honour of the author.

Turning to the stars in which the present writer and many of your readers have been interested during the past two years, Mr. Chandler, in his notes, says of Mira o Ceti:—

"806. Discovered by Fabricius, 1596; recognized as periodically var. by Holwarda, 1638. Principal epoch of elements in catalogue corresponds to Ep. 227 of Argelander. Periodical terms given in Second Catalogue are here suppressed. Although they are undoubtedly real, complication with other unknown terms makes the accurate prediction of phases at present impossible. 9^m 1 foll. 7^s 7, 10″ N."

This satisfies my contention, and shows that the discussion on Mira in KNOWLEDGE last year was both timely and useful—in good season and with good cause.

It is remarkable now, at the close of the third centenary of its discovery, that such an announcement should be made, and the question naturally arises: Has a new term come in, or have the observations been more frequent and careful—the observers more numerous and self-relying? No doubt new blood, fresh thought working beyond the shadow of great minds, away from the influence of authority, is useful, if not essential to development and progress. Be this as it may, Mira the Wonder sinks to her third centennial minimum a greater wonder—a deeper mystery—than ever.

Before quitting this subject, it may be useful to say that full weight is not given by the writer to his estimate of the light of Mira, January 19th (KNOWLEDGE, June). The conditions were not quite normal.

In reference to R Leonis, which has also been mentioned in these notes, Mr. Chandler says:—

"3493. The periodical inequality of the elements in the Second Catalogue certainly exist. But the observations of the last few years show that it is complicated with other unknown terms. Until the law is developed by future observations, it seems best to use only the uniform period of the catalogue for prediction of phases."

In the last eight years the errors in maximum of this star have been as follows:—

1888.	Yendell ...	+ 6^d	
1889.	Yendell ...	+ 11	
1890	Yendell ...	+ 8	
1893.	Gruss and Lasker	+ 4	
1894.	H. M. Parkhurst	− 22^d	
1894.	Sawyer ...	− 28	
1895.	H. M. Parkhurst	− 50	
1895.	Yendell ...	− 33	
1896.	Yendell ...	− 38	

Mr. H. M. Parkhurst has made no report on this star as yet. The present writer's figures, which have already appeared in KNOWLEDGE, are, for 1894, 1895, and 1896: -22^d, -42^d, and -40^d respectively. The change, so sudden and so definite, is remarkable and suggestive of a new force of an unknown nature. And it will hardly escape attention that while a retarding force has operated on one of these stars, an accelerating force has acted on the other, and in nearly equal times; one being behind about as much as the other is ahead of time.

Of R Scuti, 6733, Mr. Chandler says: "Large irregularities." "Argelander found bright and faint minima, usually alternating, and this has been confirmed by all subsequent observers." He states the main period and gives no point of departure. A well-known observer writes me, "No elements yet devised will fit this star long." The maximum of R Scuti is due 26th July; but a week ago it was the faintest star in the little group and was close to minimum.

Much new matter has been added to the Third Catalogue, and it seems indispensable to observers of variable stars.

Memphis Town, U.S.A. David Flanery.

THERIDION LINEATUM—A NEW VARIETY.

To the Editors of Knowledge.

Sirs,—At the beginning of August I found on a nut hedge at Elmsett, Suffolk, a bright-coloured yellowish-green spider, devoid of markings on the upper part of the body, and only marked by faint grey transverse lines under the abdomen. Having never met with this spider before, I shall be glad to know if any reader of Knowledge is acquainted with it. This variety appears of rather sluggish habit, and is not retiring; it drops by a short line, and then commences fresh operations among the leaves. I note that the colour has a strong "protective resemblance" to that of the leaves where I found it. Size rather smaller and abdomen more globular than the variety of theridion, Plate IX., I*b*, in Staveley's "British Spiders."

Samuel Barber.

SUNSPOTS.

To the Editors of Knowledge.

Sirs,—It would be very interesting to know, if those who make solar physics their study would tell us, whether they think the decline of sunspots and faculæ which is now taking place, in any way causes a decline of storms here.

It seems to be acknowledged that any sudden disturbance on their part (as September 1st, 1859) causes at once a corresponding electrical storm here.

We seem to have by no means had as many thunder-storms as usual this year. It would be interesting to know whether, on the average, the storms are less as a rule when the spots are at a minimum, or not.

Albert Collison.

[Both the late Mr. Whipple and Mr. Ellis, than whom there are no higher authorities, regarded the supposed correspondence between the solar outburst of September 1st, 1859, and the small magnetic movement observed at Kew and Greenwich on the same day, as a mere accidental coincidence. Magnetic movements are the only terrestrial phenomena which have as yet been conclusively shown to vary in connection with the changes in solar spots, and even in their case the relation is so far from being a simple one that, beyond a general correspondence in the two curves, and a rough coincidence as to the time of certain exceptionally large disturbances, we are unable to state anything as to its character. To trace a connection between terrestrial weather and sunspots, should it ever be accomplished, will be a far more intricate task, and it may safely be predicted that the complicated irregularities of English seasons will not furnish us with our first clues towards a solution of the problem.—E. Walter Maunder.]

THE THEORY OF THE TIDES.

To the Editors of Knowledge.

Sirs,—Will you allow me to notice briefly the letter of your correspondent Mr. G. H. Hill, in your September Number?

In the "weight" theory there is an undoubted cause for tide bulge, but an insignificant one, the actual amount of its insignificance not being worth dispute. Nor does it seem material whether one has in mind the full force of gravity or its diminished effective force, when one says that the tidal power of the moon can raise nothing towards herself in direct opposition to gravity. The numbers quoted in his third paragraph are now obsolete, the data having been changed since the calculations were made.

The quotation from the "Outlines" offers no explanation of how "the difference of the attractions" raises up the waters; but, reading further on, we find that the author, following up his analogy of perturbation, gives an explanation of the tide bulges which is remarkable among explanations for containing no trace of the ideas of "suction" and "slip." He shows that the tidal forces, with him the "disturbing force," when compounded as a whole with gravity, give for each particle of the water an effective gravity of altered intensity (1) and of excentric direction (2); and, applying to that state of things the law "which requires the direction of gravity to be everywhere perpendicular to the surface of a fluid in equilibrio," he deduces the form of an elongated ellipsoid.

The application of that law involves the admission, though it somewhat conceals the fact, that the agent in the change of form, or bulging, is water pressure due to the tidal forces.

J. Creagh.

Notices of Books.

Report of the United States National Museum, 1893. Pp. 794. (Washington: Government Printing Office.) We are not among those who take every opportunity to belittle the systems of our mother-country, but with this ponderous and wonderful report before us the thought comes that British Governments could learn a lesson of liberality to science from across the Atlantic. The report is not merely a bald statement of work accomplished at the United States National Museum in 1893; it is a library in itself on museums and their administration. There is a section on recent advances in museum method, illustrated by sixty fine process-blocks representing specimens, groups, and methods of arrangement in the United States National Museum. There are also numerous long papers describing and illustrating collections in the museum, among the subjects being the poisonous snakes of North America, Chinese games with dice and dominoes, the onyx marbles, cowbirds, primitive American armour, the weapons and wings of birds, and the ethnology of Tibet. In fact, the report is a veritable mine of information which curators of museums know and treasure, and which naturalists generally should take the earliest opportunity of seeing.

On the Adjustment and Testing of Telescopic Objectives. (T. Cooke & Sons.) The first edition of this little work, published in the summer of 1891, met with such a favourable reception by the astronomical public—being deemed worthy of being translated into German by Dr. Rudolph Straubel, of Jena, and into Italian by Prof. Tocchini—that the authors felt justified in preparing a second and larger edition. This is all the more necessary since Messrs. T. Cooke & Sons, in the spring of 1894, introduced to astronomers a new objective, consisting of a triple lens, adapted for either photographic or visual observations, and superior to the double lens hitherto made in being perfectly achromatic. This form of object glass has proved so entirely satisfactory that it will probably be alone made at the Buckingham Works, York, to the exclusion of all other.

The first part of the book corresponds to the first edition, but it has been carefully revised, and a description of the new Cooke photo-visual objective added. Mr. Dennis Taylor's two valuable papers, read before the Royal Astronomical Society, on "Secondary Colour Aberrations" and "A Perfectly Achromatic Refractor," are added as supplements, and increase the completeness and value of what was from the beginning a most useful little manual.

Whilst cordially recommending the entire book to those who use the telescope, we would draw especial attention to some points in the chapter on the general treatment of objectives. The need, as great in the case of refractors as

XUM

of reflectors, is emphasized of preserving the objective in dry pure air. In humid climates a fine film of moisture deposits or exudes from the interior surface of the crown lens, and on this moisture a minute thread-like fungus spreads and decomposes the crown glass, resulting in the ultimate deterioration of the lens. The simple preventative is suggested of placing within the dew-cap some thicknesses of flannel, left toasting before the fire until perfectly warm and dry, after the observations for the night are finished. Curiously, this film does not invade the flint surface. The tarnish which appears on this glass in reality increases very greatly the transparency of the objective. Whereas a thin plate of dense flint glass will, when freshly polished, reflect back from its two surfaces about eleven per cent. of the light falling upon it, and transmit eighty-nine per cent.; the same plate, when tarnished to a sort of dull grey-brown or blue (as viewed by reflection), will reflect back only about five per cent., and transmit ninety-five per cent.

Southern Stars: a Guide to the Constellations visible in the Southern Hemisphere. By M. A. Orr. With a Preface by John Tebbutt, F.R.A.S. The Rev. James Gall's "Easy Guide to the Constellations" has been the first primer which has taught a great number of northern observers their stellar alphabet, and on the acquaintance with the forms of the constellations and the names of the stars to which they have been thus introduced, has followed the rise of a love for astronomy which has in many cases borne rich fruit. It is, therefore, with especial pleasure that we welcome Miss Orr's modest little book. For the southern heavens present a rich harvest which there have been very few labourers to reap, and hitherto it has seemed much more difficult to arouse a real interest in astronomy in southern latitudes than here in Europe. We trust that Miss Orr's book is at once an indication of an awakening interest, and that it will greatly foster it. It should do so, for the work is most clearly written, and, following on the well-chosen lines of Mr. Gall's book, is in every way a thoroughly worthy companion and supplement to it. With Miss Orr's neat little maps and lucid descriptions ready to his hand in so convenient a form, the South African or Australian will now be without excuse who looks upon the glories of his southern skies as a mere confused crowd of unknown and nameless stars. It should be added that the thirty maps are not confined wholly to the southern hemisphere, as six of them form a complete miniature star atlas for the entire heavens.

In the *Journal of Botany* for August there is a very instructive paper by T. Kirk, F.L.S., on "The Displacement of Species in New Zealand," showing the effects of introduced animals and plants upon the old fauna and flora of that island. Darwin's theory of the "survival of the fittest" receives further corroboration from the many interesting facts recorded in this paper. The author says: ". . . . the invading army of plants has brought in its train a still more dangerous host of animals. . . . . In the animal kingdom the invaders whose agency is most dreaded are members of the Invertebrata: the mussel scale, the black scale, and many others, together with numerous species of plant lice, will occur to you as belonging to lowly developed forms of Insecta. Higher in the scale are the Hessian fly, wireworm, turnip fly, and others, while numerous species of earthworms, molluscs, birds, and even mammals, affect alike both fauna and flora." Again, showing how plants adapt themselves to their environment, the author reports that "out of one hundred and three species of plants recently introduced with ballast from Buenos Ayres, eighty-six are already naturalized." In the same journal (pp. 349-351) there are some new species of marine algæ, from Natal, described by E. M. Holmes, F.L.S.

In the *American Naturalist* for July there is a paper on "The Classification of Diatoms" (*Bacillariaceæ*), by C. J. Elmore, in which the author discusses the various systems of classification employed by Kirchner, Kuetzing, Paul Petit, Van Heurck, Murray, and others. In the classification which this author adopts—that of Paul Petit, as approaching most nearly a natural one—several of our most cherished species (?) are shown to be mere varieties of the *Navicula iridis* (Ehr.). The author also temperately discusses the reasons of the imperfection of the geologic records of the early history of these Diatoms.

Entomologists who are interested in the flower-visiting habits of insects will find an interesting paper upon "The Bees of the Genus Perdita" in the *Proceedings of the Academy of Natural Sciences*, Part I., 1896; and though we do not believe that the number of species will be found to be correct on further examination (our author describes seventy species, of which he believes fifty-five to be new), still the results given in this excellent paper are well worthy of a more extended notice than can be given in these columns. The name of the author is T. D. A. Cockerell.

Evolutionists, and students of the history of the Mammalia, will do well to make themselves acquainted with one of the latest books upon the subject, viz., "The Primary Factors of Organic Evolution," by Prof. E. D. Cope, Pennsylvania. The splendid memoirs written by this distinguished palæontologist rival those of our own country upon these subjects. Those who have had occasion to refer to the works of this author know how thoroughly up to date the information is. In the present work the author gives his reasons for disagreeing with the classification adopted by Dr. Amenghino of a portion of the group of Ungulata. "Amenghino placed the group" (called by Dr. Amenghino "Litopterna") "under the Perissodactyla, but the tarsus and carpus are of a totally different character." The author further describes the different characters of the feet, and the dentition of these animals—found by Dr. Amenghino in the Cenozoic formations of Argentina—which leads him to indicate the origin of these species from a different order of the Condylarthra than of that adopted by Dr. Amenghino. If we remember rightly, Mr. R. Lydekker visited the museums of Buenos Ayres and La Plata to help revise the work of the Argentina palæontologists; but, as far as can be seen, with no success as to the classification of these animals. Prof. Cope writes with all the fire of Weismann in defence of the transmission of the germ plasma and of progressive evolution.

RUNES AND OGHAMS.

By Gertrude Burford Rawlings.

Runes of war know thou
If great thou wilt be!
Cut them on hilt of hardened sword,
Some on the brand's back,
Some on its shining side,
Twice name Tyr therein.
Sea-runes good at need,
Learnt for ship's saving, [horse;
For the good health of the swimming
On the stern cut them,
Cut them on the rudder-blade . . .

Word-runes learn well
If thou wilt that no man [gavest
Pay back grief for the grief thou
Wind thou these,
Weave thou these,
Cast thou these all about thee,
At the Thing,
Where folk throng,
Unto the full doom faring.
Thought-runes shalt thou deal with
If thou wilt be of all men
Wisest-souled wight, and wisest.
—*Brynhild's Song: "Volsunga Saga."*

ALTHOUGH it is at present an exceedingly doubtful point as to whether those strange old-world characters known to antiquaries as "runes" and "oghams" respectively, are or are not connected with each other either collaterally or lineally, they form a most interesting subject of speculation. There

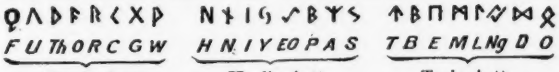
are several points of resemblance between the two alphabets, and there are also several points of divergence.

Runes undoubtedly originated in the North of Europe, but from what, or at which period, no one knows. Mythologically, Odin is said to have invented them—the Northmen, like most other races, believing that all knowledge, wisdom, and arts originated with their divinities and traditional heroes. Hence the old saga:—

> Thought-runes shalt thou deal with
> If thou wilt be of all men
> Fairest-souled wight and wisest.
> These areded,
> These first cut,
> These first took to heart high Hropt [Odin].

Modern conjecture—conjecture only—refers the runic characters to the Phœnician, the prototype of the Greek and Latin alphabets. Runes, and oghams as well, were primarily intended not to be *written*, but to be *cut* (*see* quotation above) in wood, stone, horn, etc., as may be seen from the simple combinations of straight lines which make up both alphabets. A few books, however, exist, which are written in runes. The word "rune," Gothic *râna*, signifies something hidden, secret (knowledge, more particularly), and, as M. Botkine, in his "Chanson des Runes," expresses it, not only science and power, but the means of communicating these. Runic inscriptions are comparatively frequent in England, and occur also in Scotland; but Wales and Ireland have not a single example, excepting a small coin bearing runic letters which was struck at Dublin. It is a curious fact, showing what bold adventurers the Northmen were, that actually in North America runic inscriptions have been discovered. One at Arrow Head, on the Potomac River, is cut in a rock, and commemorates the widow of a Norse chieftain. It runs:—"Here lies Syasi, the fair one of Western Iceland, the widow of Koldr, sister of Thorgr by her father, aged twenty-five years. God be merciful to her."

As remarked above, the time at which runes were invented is uncertain, but it has been thought that they should be attributed to the first or second century B.C. The alphabet, or "futhorc," as it is called from its first six letters, is divided into three parts, called "aetts" or families, and named after the first letter of each family: Frey's (F) Aett, Hagl's (H) Aett, and Tyr's (T) Aett. The oldest form of the futhorc, the Gothic, from which are derived the later local forms of the Scandinavian, the Anglian, and the Manx runes, is as follows:—

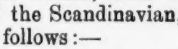


Frey's Aett. Hagl's Aett. Tyr's Aett.

The futhorc was introduced into Britain by the Jutes in the fifth century, soon after the departure of the Romans, and continued to be used till the tenth or eleventh century. Runes abound in Jutland and in Scandinavia generally, though they were quite unknown to the Saxons and Germans. Anglian runes are generally found on monumental or sepulchral slabs—some of them Christian—and on those large sculptured crosses still existing in different parts of our islands. As an example of the latter we may instance the Ruthwell Cross. This takes its name from Ruthwell, in Dumfriesshire, which in early times formed part of Northumbria. Its date is probably about 680 A.D. It is covered with carvings of Scriptural subjects arranged in panels, whose frames are cut with runes relating "The Dream of the Holy Rood," a poem ascribed to Cædmon, the miraculously-inspired poet of Whitby. In this poem a sleeper is supposed to dream of a marvellous tree, which speaks to him and tells how it was hewn down by men with axes, and set upon a "beetling headland." Seeing to what use it was to be put, it would have broken itself, but dared not "against the Dreetan's word." It describes the Crucifixion—the Saviour is fastened on it. "Rood was I reared now, Rich king heaving." And then: "Wept all creation, Wailed the fall of their King, Christ was on Rood."

Another object ornamented with runes is a casket of whale's bone in the British Museum, the history of which is unknown. It is of Northumbrian work, and is nine inches long by seven and a half broad, and five and one-eighth high. On the first side it shows carvings representing Romulus and Remus; on the second, Titus storming Jerusalem; on the third, the delivery of the head of John the Baptist; and on the lid a scene from the Teutonic legend of Egil. Of the fourth side only a fragment remains. The date of this casket is somewhere between 700 and 800 A.D. The carvings are accompanied by descriptive runes.

Although the greater number of British runic inscriptions are found in the North of England, the oldest extant specimen, assigned to the fifth century A.D., belongs to Sandwich, in Kent. Two headstones thus inscribed have also been found in London, in the neighbourhood of St. Paul's, one of which may be seen in the Guildhall Museum.

The ogham characters are found in great numbers in Ireland; there are some in Wales and the extreme South-West of England, and a few in Scotland. None are known outside the British Islands. They are formed by dividing the alphabet into four aicmes or kinds, of five letters each. The first contains **B L F S N**, the second **H T D C Q**, the third **M G Ng St R**, and the fourth the vowels **A O U E I**. The letters are represented by one, two, three, four, or five strokes for each letter, according to its order in the aicme to which it belongs. A line is drawn, which may be either perpendicular or horizontal—we will consider it as horizontal in the present instance—and the strokes representing letters of the first aicme are placed *under* this line, those representing letters of the second aicme are placed *above* the line, those representing letters of the third aicme *diagonally through* the line, and those representing letters of the fourth aicme cutting the line at right angles. Thus, the Celtic word *maqi* (mac), meaning "son of," would stand  . In the case of the main line or stem being perpendicular, the strokes of the first aicme would be placed at the right hand, and those of the second at the left hand, the others as before, and the inscription read upwards. As a rule the edge of the stone is used as the stem line, and the strokes are on one side of the stone, or its face, or both, according to the aicme they belong to. The oldest form seems to have been that in which a separate perpendicular line was taken for every letter, instead of one common line being used for all.

It is a curious and as yet unsolved problem as to whether these oghams were derived from the futhorc. One of the points in which the two alphabets resemble each other is that to the inventors of both the forms of the characters seem to have been suggested by trees—or, at any rate, they themselves suggested trees. Canon Taylor, in his interesting work, "Greeks and Goths," says that "both the runes and the oghams were regarded as constituting a mysterious alphabetical forest in which grew trees of twenty species;" and, moreover, the names of the Irish oghams were all names of trees, *e.g.*, A, *Ailm*, or Fir; B, *Beith*, or Birch, and so on; though certainly these names, which went by the name of the "Bethluisnon

XUM

alphabet," could be given to ogham and Roman characters alike. The Irish peasantry have still an old verse concerning the oghams, beginning as follows :—

> For B one stroke at your right hand,
> And L doth always two demand;
> For F draw three, for S make four,
> When you want N you add one more.

And a case is recorded within comparatively recent years in which a man was summoned for having his name on his cart in ogham characters.

In support of his view that it was on the futhorc that the oghams were originally founded, Canon Taylor propounds a quaint theory as to the method of derivation, of which the following is a brief summary.

He suggests that the inventor of oghams, on examining the runes, would find that the latter could be resolved into five classes containing four letters each, viz.: (1) *Branch runes*, those with markedly tree-like forms, such as ᛉ, represented by oghams with one twig, ᚁ ᚂ ᚃ ᚄ; (2) *Fork runes*, such as ᚢ, represented by oghams with two twigs, ᚅ ᚆ ᚇ ᚈ; (3) *Loop runes*, such as ᚹ and ᛟ, represented by oghams with three twigs, ᚉ ᚊ ᚋ ᚌ; (4) *Crook runes*, such as ᛊ, by oghams with four twigs, ᚍ ᚎ ᚏ ᚐ; and (5) *Root runes*, such as ᛏ and ᚱ, by oghams with five twigs, ᚑ ᚒ ᚓ ᚔ. We may here remark that the original word for these "strokes" is *fleasg*, meaning twig. The prevailing idea is the resemblance to trees,—trees with branches, trees with forks, trees with looped or interlaced branches, trees with crooked branches, and trees with their roots visible. The result of such an arrangement, which it might be wearisome to the reader to give in detail, would be the order of letters as stated above, B, L, F, S, N, etc. "That this notion is fanciful," adds Canon Taylor, "is no objection to it, but rather an argument in its favour, when we remember the fancifulness of the whole system of oghams and their names."

Stones with ogham inscriptions may be seen in the British Museum, among them being the slab known as the Fardell Stone, found near Ivybridge, in Devon, which bears the Roman legend, FANONI MAQUIRINI, and, in oghams, SFAQQVQAS MAQI QICI, *i.e.*, SFAQQUQAS (or Sfaqqucci) son of QICI. Sir S. Ferguson surmises that such "uncouth designations may have been adopted as evidence of self-disparagement by some Christian ascetic."

As is the case with runes, the date of the invention of oghams is uncertain. Professor Rhys considers that it was not later than the fifth century A.D. The Irish tradition is that they were introduced by the "early half-mythical colony of the Tuatha de Danaan," who are supposed to have come by way of Scotland from the North. And this tradition is supported by the fact that only in those districts where the Northmen are known to have penetrated are ogham characters found.

British oghams, with but one exception, are always accompanied by a legend in Roman letters, which is not the case with runes.

It is possible that oghams are a later and greatly modified form of runes: the latter, having passed through the intermediate forms of tree and bind runes, finally resolving, under some at present unknown conditions, into oghams—although, at the same time, supposing this to be the case, the use of the old runes was by no means entirely abandoned in favour of the newer characters.

THE ASH.

By George Paxton.

> "There's something in that ancient superstition
> Which, erring as it is, our fancy loves."

THE ash (*Fraxinus excelsior*), one of the noblest of our forest trees, is known by its tall, graceful form and elegant foliage. It may be called the "Tree of Superstition," because we find, wherever it grows, and intimately connected with all kinds of ashes, superstitions, mythological lore, and legends without end. A glance at a few of these may prove interesting.

In ancient Scandinavian mythology the ash plays an important part. "Igdrasil, the ash tree of existence, had its roots deep down in the kingdom of Hela, or Death; its trunk reached heavens high, and spread its boughs over the whole universe. At the foot in the death kingdom sat three Nornas (Fates)—the Past, Present, Future—watering its roots from the sacred well. Its boughs, with their buddings and disleafings—events—things suffered—

Fig. 1.—Leaves and Seed Vessels of the Ash.

things done—catastrophies. On the summit was perched an eagle who watched the course of all earthly affairs, assisted by a squirrel who employed his time in descending

and ascending to examine into and report upon what was happening beneath."

Although the following seems to us rather absurd, it is not such a very long time ago since such things were practised and believed in in many parts of the South of England. "To cure sickly or diseased children a split was made in the stem of a growing ash and held open by wedges; through this opening the child was passed naked. The tree was then bound up, and if it grew well together again that was considered a sure sign that the charm had worked and the child would recover."

A "shrew-ash" was made by entombing a live shrew-mouse in an auger hole made in the bole of the tree—no doubt with many spells and incantations long since forgotten. At any future time a few light strokes with a branch taken from such a tree would instantly cure cattle and horses that were believed to have been bewitched or cramped by the pernicious shrew touching them or running over their limbs while asleep.

The ash is a true native of Great Britain, abundant from John o' Groat's to Land's End. It is indigenous to Europe, North Africa, and North America. It grows to a large and handsome tree, eighty to one hundred feet in height, with a girth often approaching twenty feet. The leaves are pinnate, with five or six pairs of leaflets, serrated. The flowers, which appear before the leaves expand, are small, often numerous, and of a dark purple colour. The succeeding fruit, the well-known keys or "lock and keys," are long-shaped, thin, seed vessels (Fig. 1). On some trees these are very abundant, and being firmly attached to the twig often remain on the tree all the year round. These numerous bunches, turning brown to black in late autumn, when all the leaves have fallen, are very conspicuous; in fact, the ash may be readily distinguished even in mid-winter by these clusters. The wood, although the ash is a quick grower, is very valuable, on account of its toughness and elasticity; these qualities it possesses to a greater degree than the wood of any other British tree. Both Greeks and Romans made their spear handles from its tough saplings, and used it for agricultural implements; for the latter purpose it is still in demand. The carpenter, wheelwright, cooper, and turner, all find it excellent wood for their various purposes; cabinet makers value the knotty parts of the trunk and roots, which they call "green ebony"; for walking sticks, blocks, oars, etc., there is no better wood. In point of value it comes next to the oak itself, and before it in this respect—that it matures its wood at a much earlier period. An ash pole three inches in diameter is as durable and valuable for any purpose to which it can be applied as the timber of the full-grown tree.

The ash is one of the last of our trees to put on its summer robe—

> "The tender ash delays to clothe herself
> When all the woods are green."

It is also among the first to cast off its covering. Perhaps this is why it has been called the "Venus of the Wood," but we rather suspect it owes this title more to its gracefulness of form than to its love of nudeness.

The flowering ash, *Ornus*, is cultivated in Sicily principally on account of the sweet sap it exudes called "manna"; it grows twenty to twenty-five feet high. The sap flows spontaneously during the greater heats of summer from trees in the most favoured situations, but oftener it is obtained from incisions made through the bark. The clear sap speedily hardens on exposure to the air, and is the "manna" of commerce. When fresh it is nutritious and agreeable to the taste, and is used by the natives as food; but as it turns old it acquires laxative qualities.

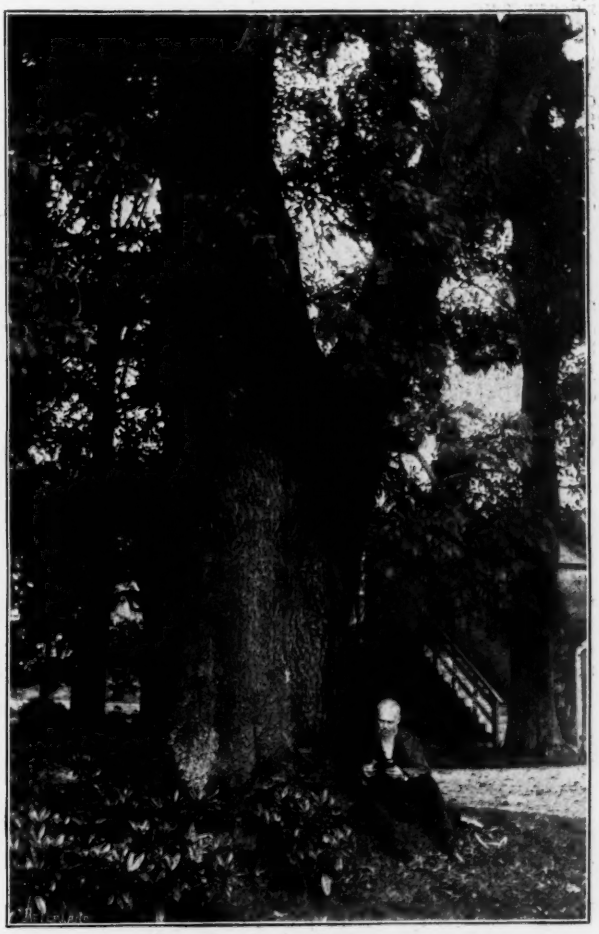


Fig. 2.—Ash at Hunterston, Ayrshire, known as "The Resting Tree."

Fig. 2, a fine ash with a girth of over sixteen feet at five feet from the ground, is growing at Hunterston, Ayrshire, and is known as "The Resting Tree." Popular weather lore has various sayings as to whether the summer will prove a dry one or the opposite, according as the ash comes into leaf before or after the oak; but these rhymes seem to be diametrically opposite in different parts of the country.

WAVES.—X.

RIPPLING.

By Vaughan Cornish, M.Sc.

On shallow shores the sand is rippled by the waves, forming a regular series of ridges and furrows, ranged parallel to the wave front. The pattern often remains when the ebbing tide leaves a stretch of wet sand behind it, but the receding waters blur the ridges, rounding off the sharp edge of the perfect

ripple marks. To see them in perfection one must look down through the clear water on a calm day. A pair of long wading boots enables one to examine in comfort the ridges nearest to the beach. In order to see those further out I sometimes float just beyond the breakers in one of tl ese flat-bottomed coracles which are still used on the Wye. It draws scarcely any water, and is so light that one can carry it on one's back and launch it unaided. Sometimes, however, it capsizes.

In the clear waters of Lake Geneva, according to M. Forel, the ripple pattern can be seen at a depth of thirty feet. On our own coasts the ripple mark ot Torbay is celebrated, and has been well described by Mr. Hunt in the *Proceedings of the Royal Society*, Vol. XXXVI., 1883-4.

The phenomenon has two aspects, according as we have regard to the motions of the water or to the tactics of the sand. The former have been studied in exquisite detail by Prof. G. H. Darwin, and stand recorded in the volume of the Royal Society's *Proceedings* to which reference has been made. The tactics of sand under rippling action were dealt with in two papers read at the recent meeting of the British Association by the present writer, and this article is confined to the fluid motions. If a trough or basin partly filled with water be gently rocked, a wave travels backwards and forwards from end to end of the trough, and sand placed upon the bottom of the trough soon becomes rippled. The experiment is readily tried, always succeeds, and is extremely pretty and instructive. Rippling, indeed, is so readily produced that it may commonly be observed when a little sediment has settled in a basin; the slightest disturbance of the water sets up an oscillation, and this almost inevitably ripples the sediment. The fine deposit which settles from hard water after heating readily ripples: the pattern may be seen at the bottom of a jug of shaving water. A glass trough with vertical sides is best for the experiments upon ripple marks, as they can then be seen in section, and the eye can be placed close enough to watch the movement of the sand grains. Having made some regular ripple marks by oscillation, Prof. Darwin tried the effect of exposing them to a current. He then observed that small particles lying on the surface of the sand climbed up the *lee* slope of the ripples, apparently against stream. This showed the existence of an eddy or vortex on the lee side of the ridge. By giving a sudden motion to the water he was able to see the sand piled up on the weather side by the direct current, and on the lee side by the eddy or vortex. In order better to observe the action of the vortices, a drop of common ink (not aniline ink), with a little sulphate of iron added to it, was squirted to the bottom of the water in the furrow between two ridges. On causing the current again to pass, the ink was seen to divide into two portions, one being sucked back up the lee side of the ripple mark, and the other being carried by the direct stream towards the next crest. Fig. 1 is Prof. Darwin's representation of the stream-lines during this action.

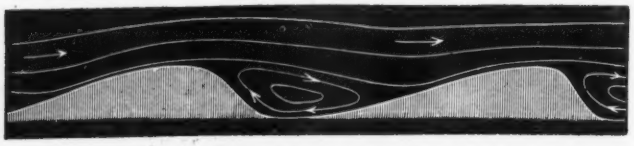


Fig. 1.—Action of Current upon Ripple Mark.

By the aid of a drop of the heavy ink it was found possible to watch the more complicated action of the vortices during oscillation of the water. Rippling is started by sand grains sticking, and thus causing little vortices or eddies on their lee side. If the agitation is so violent that the sand does not stick, but is simply swept along, no ripple mark is formed. A steady current, however, seems to be incapable of producing *regular* ripple mark, such as that of the seashore, which was found to be due to the periodic strengthening and weakening of vortices on either side of each ridge as the direction of oscillation changed. The drops of ink recorded almost perfectly the effect of each oscillation, for a pumping action, due to the upward motion of the vortex, separated the convolutions of the thread of ink, which formed a sort of tree. Fig. 2 shows the successive stages of the phenomenon for half an oscillation, the water swinging from right to left. The oscillation of the sand crest is shown, and the arrows at the base of the ink-spiral show the motion of the vortices which build up the ridges and scour out the troughs. "The only difficulty," says Prof. Darwin, "is in Stage IV., where the root of the (ink) tree is in the state of transference from one crest to

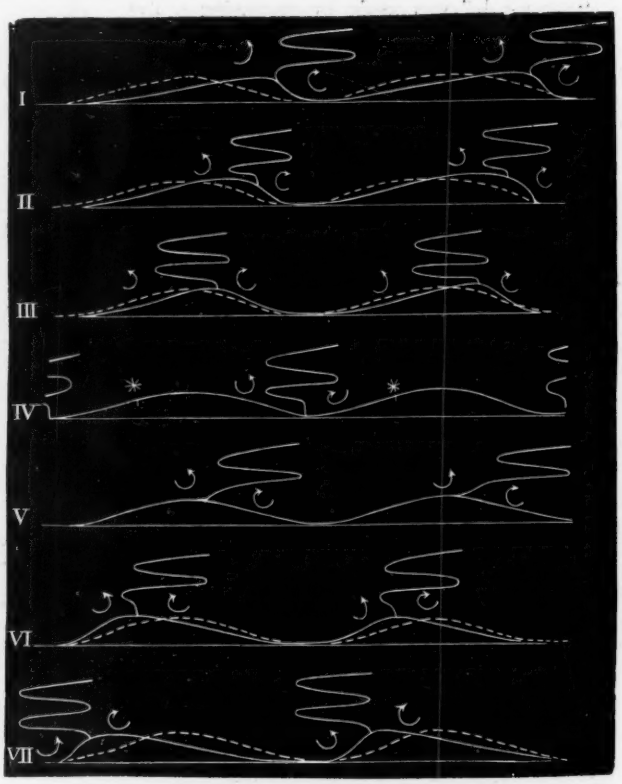


Fig. 2.—Action of the Vortices in Ripple Making.

the next. In this stage the vortices would seem to be in the act of degrading the ripple mark, but they are not either of them at their maximum of intensity, and the time during which this holds good is exceedingly short compared with the whole semi-period of oscillation." The form given in the figure (Stage IV.) of the ripple mark in the mean position of the crest is not exactly the true shape, which is flatter in the troughs and sharper on the ridge, with hollowed sides and a knife edge at the crest. The form at either end of the swing, a sloping back and a steep lee face, is like that of the rippling produced by wind when blowing over loose sand; the form is homologous with that of water waves raised by a wind which keeps constant in direction. On the other hand, I have frequently noticed the symmetrical ripple-mark form of the waves in a cross sea: for instance, when sailing round headlands. With an off-shore wind two sets of waves grow in the bays on either side, and, travelling seawards, meet and pass through each other just off the headland. The momentary combinations of the opposing billows give the steep, symmetrical waves. They make what sailors call a "nasty lop" off headlands, even when there are no tidal currents or rocky ledges to increase the turbulence of the water.

Rippling is generally produced at the surface of two fluids of different densities which are in relative motion. A curious example is that of tar and water. If water be poured upon the tar, and the vessel be rocked, the surface of the tar is quickly rippled, and the sticky crests of the ridges are jerked backwards and forwards in clumsy imitation of the dance of the sand in the seashore ripples. More important, however, is the rippling which occurs between layers of air of different density when the upper and the lower layer have different motions. The visible evidence of such rippling is the formation of beautiful parallel bars of cloud, in which, as Mr. Ruskin wrote long

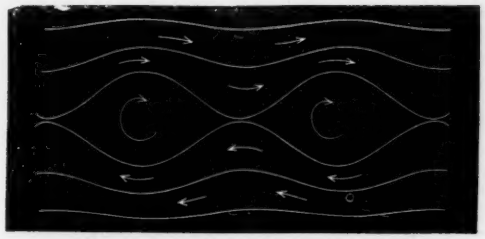


Fig. 3.—Formation of Cloud Ripples.

since, "the vapour . . . . falls into ripples like sand." ("Modern Painters," Vol. V., Part VII., chap. i.)

The condition at the flat surface of two fluids of different densities and capable of mixing, is unstable when the fluids are in relative motion, the form of the surface being liable to undergo great change in a sudden and perhaps tumultuous manner. The two surfaces become corrugated, and between them are interpolated vortices, which act as friction rollers, enabling one surface to glide smoothly over the other. In these vortices the two fluids mix (*see* Fig. 3).

Now the mixing of two airs of different temperature is a well-known method of producing condensation of vapour with formation of a cloud. Probably, therefore, the parallel bars of cloud mark the position of the vortices in air rippling—not, as some have supposed, of the crests of the waves of the lower layer of air (Fig. 3). Once the attention has been drawn to these bars one is struck by the frequency of their occurrence. They occur chiefly in the upper regions of the cloud world. The wave-length is remarkably constant in any one group of bars, but the scale of the pattern varies greatly. A distance of one degree to two degrees of arc from bar to bar is a common size for the smaller and better defined ripples, which, for a distance of thirty thousand feet from the observer, corresponds to a wave-length of two hundred and fifty to five hundred feet; but I have seen the larger sort of bars with a wave-length of probably half a mile or more.

The best defined cloud bars have a sharp edge at one side where the cloud looks thickest, so that the vortex is probably not usually symmetrical, as represented in Fig. 3. I have often noticed the densest part of the bars on the weather side, *i.e.*, the direction from which the clouds drift; but on some occasions it seemed as if the contrary

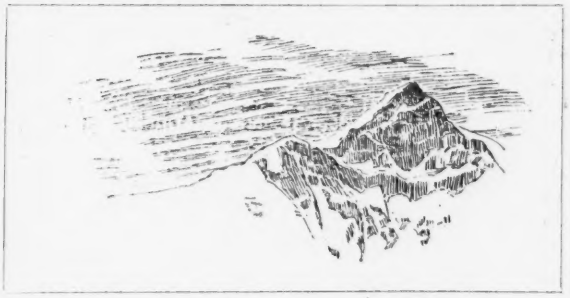


Fig. 4.—Cloud Ripples, as seen from Grindelwald.

were the case. Sometimes the bars form *in cælo puro*, a beautiful phenomenon which I have seen on several occasions during the present year. As one bar after another appears, one learns to look in front of the lengthening group to catch the first beginnings of the next forming bar, fixing one's attention on the exact spot in the blue sky where its appearance is due. At other times the ripple bars are formed when a wind blows upon a cloud; this I have frequently noticed to occur in the fleecy clouds which form upon the tops of high mountains soon after the gathering power of the sun has begun to draw up moisture from the ice and snow.

Fig. 4 is from a sketch made at Grindelwald, April 17th, 1896, 7.15 A.M. The sky was quite clear at sunrise, then the snow slopes and glaciers began to "smoke," fleecy

Fig. 5.—Banner Cloud above the Eiger, from Grindelwald.

masses collected round the summit of the mountains, and these were then blown into ripples.

The perfect bar-like form with straight edges does not give one the impression of a swirling motion, but I have

often seen swirls of cloud ranged in parallel rows, each swirl like a single puff of smoke, the swirls in each row growing in size and thus getting closer together until a continuous bar was formed.

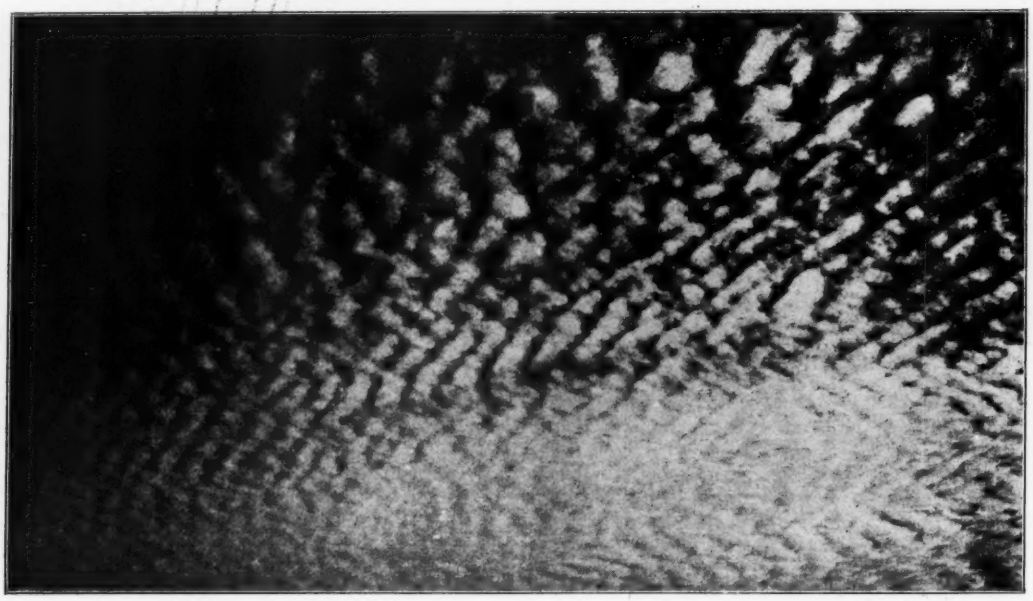
With a veering wind the direction of rippling is changed, and a barred may be changed into a dappled sky, the existing clouds being furrowed and cut into diamond shape.

An air billow and an eddy, or vortex, is formed when wind blows over a sharp ridge—an instance of the rule that an eddy is formed behind any sharp-edged body which obstructs a current. In air, however, a single obstacle does not seem to give rise to a train of waves, such as is formed to leeward of a boulder in a shallow stream, but only to one, conspicuous, billow. Air diffuses more rapidly than water, and its inertia is much less, so that a gravitation wave in air must, I apprehend, die out quickly. The vortex in the lee of a mountain top exposed to wind produces the banner cloud, a phenomenon very characteristic of Alpine districts. Fig. 5 is from a sketch of the banner cloud of the Eiger taken at Grindelwald, April 21st, 1896, at 2 P.M. The swirling motion of the air was well shown in the convolutions of the cloud. Banner clouds frequently have the shape of long streamers. A well-known example in England is the "helm bar" often seen to the west of Cross Fell when the wind is from the east. The forms of cumulus cloud are the result of swirling motion of the air. Overhead the cumulus appears nearly circular, but when nearer the horizon it is seen to be an accumulation of kidney-shaped masses. These are sure evidence of vortices: an excellent example of this may be seen in the kidney-shaped masses of black smoke near the mouth of a steamer's funnel. This unsightly smoke also serves to show the strong wind-eddy abaft the funnel. At a certain position the smoke whirls violently towards the funnel, in the direction of the ship's motion.

I presume that the swirling motion of ascending currents of air accounts for the circumstance that the morning's sun does not spread a thin film of vapour over the sky, but, instead, produces balls of cumulus separated by blue sky. The interspaces are not regular as in the case of a wave motion, but there is a rough proportionality among the clouds.

The raising of the sea by wind is a case of rippling at the boundary of two fluids in relative motion. The difference of density, however, is so great that mixing of the two fluids cannot take place in the vortex in the usual manner, but is achieved by spraying from the crest of the water wave. In the lee of each water billow there is an eddy of air which, with a high sea, may become a source of danger to ships by taking the wind out of the sails. Above the water billows and the wind eddy the air is doubtless itself in undulations, as Helmholtz pointed out; but the peculiar character of sea waves, which are continually dying out and creating new ones behind them, as well as the complicating effects of their free run by gravitation, probably prevents the air billows from attaining any regularity.

According to Helmholtz, undulations of air, not necessarily accompanied by cloud formation, are of ordinary occurrence, and with high winds their dimensions are very great, often some miles in wave-length. Such waves, even if originating at the height of a mile, would stir the air at the earth's surface, and this has been suggested as a cause of the gusts of wind, often accompanied by showers, which occur at intervals in squally weather.



Cloud Ripples. From a Photograph in KNOWLEDGE.

The rippling of sand by wind has been alluded to. Deserts have often been compared to a sea of sand, and the likeness is real as well as apparent, for the sandhills are billows raised by the wind. Being more enduring, they grow to a greater size than ocean waves. In a strong breeze a stream of sand flies from the *crest* of each dune, just as the spray flies at sea.

The wind also ripples snow, an effect which has been shown by Mr. J. Wolff in a picture of "Ptarmigan in Winter," No. 430 of the Prescott Hewett Gift, South Kensington. I have even seen a gale of wind ripple the froth of the breakers when the return of the wave has left the froth nearly stranded on the shore.

THE FACE OF THE SKY FOR OCTOBER.

By Herbert Sadler, F.R.A.S.

SUNSPOTS are still very few in number.

Conveniently observable minima of Algol occur at 9h. 20m. P.M. on the **1st**, 11h. 2m. P.M. on the **21st**, and 7h. 51m. P.M. on the **24th**.

Mercury is visible as a morning star during the last half of the month. On the **17th** he rises at 5h. 2m. A.M., or 1h. 27m. before the Sun, with a southern declination of 2° 45′, and an apparent diameter of $8\frac{1}{4}''$, $\frac{24}{100}$ths of the disc being illuminated. On the **22nd** he rises at 4h. 50m. A.M., or 1h. 48m. before the Sun, with a southern declination of 3° 4′, and an apparent diameter of $6\frac{1}{2}''$, $\frac{45}{100}$ths of the disc being illuminated. On the **27th** he rises at 5h. 1m. A.M., or one hour and three-quarters before the Sun, with a southern declination of 5° 4′, and an apparent diameter of $6\frac{1}{4}''$, $\frac{7}{10}$ths of the disc being illuminated. On the **31st** he rises at 5h. 16m. A.M., or 1h. 39m. before the Sun, with a southern declination of 7° 20′, and an apparent diameter of $5\frac{1}{2}''$, rather over $\frac{8}{10}$ths of the disc being illuminated.

Mercury is in inferior conjunction with the Sun on the **8th**, and at his greatest western elongation ($18\frac{1}{4}°$) on the **24th**. While visible he describes a direct path in Virgo, without approaching any conspicuous star very closely.

Venus is an evening star, but owing to her southern declination is not well situated for observation; moreover, she is too near the Sun during the greater part of the month. On the **27th** she sets at 5h. 45m. P.M., or 1h. 3m. after the Sun, with a southern declination of 21° 41′, and an apparent diameter of 12″, $\frac{88}{100}$ths of the disc being illuminated. On the **31st** she sets at 5h. 45m. P.M., or nearly an hour and a quarter after the Sun, with a southern declination of $22\frac{3}{4}°$, and an apparent diameter of 12″. While visible she is near β Scorpii.

Mars is now a very conspicuous object in the evening sky. On the **1st** he rises at 8h. 33m. P.M., or 2h. 57m. after sunset, with a northern declination of 22° 55′, and an apparent diameter of $11\frac{1}{2}''$, the phasis on the preceding limb amounting to $1\frac{1}{2}''$. On the **14th** he rises at 7h. 53m. P.M., with a northern declination of 23° 28′, and an apparent diameter of $12\frac{1}{2}''$. On the **31st** he rises at 6h. 51m. P.M., with a northern declination of 24° 12′, and an apparent diameter of $14\frac{1}{4}''$. During the month he crosses from Taurus into Gemini.

Jupiter does not rise before midnight at the end of the month, and Saturn and Uranus have left us for the season.

Neptune is an evening star, rising on the **1st** at 8h. 26m. P.M., with a northern declination of 21° 41′, and an apparent diameter of 2·6″. On the **31st** he rises at 6h. 30m. P.M., with a northern declination of 21° 38′. He describes a very short retrograde path in Taurus during the month.

October is a fairly favourable month for showers of shooting stars, the most marked display being that of the Orionids on the **18th**, the radiant point being in R.A. 6h. 8m. and +15°.

The Moon is new at 10h. 18m. P.M. on the **6th**; enters her first quarter at 2h. 47m. P.M. on the **13th**; is full at 4h. 17m. P.M. on the **21st**; and enters her last quarter at 3h. 21m. P.M. on the **29th**. She is in perigee at 5h. A.M. on the **7th** (distance from the Earth, 221,940 miles), and in apogee at 6h. A.M. on the **21st** (distance from the Earth, 252,500 miles).

Chess Column.

By C. D. Locock, B.A.Oxon.

Communications for this column should be addressed to C. D. Locock, Burwash, Sussex, and posted on or before the 10th of each month.

Solutions of September Problems.

No. 1.—1. Q to QR8, and mates next move.

No. 2.—1. Q to QB6, and mates next move.

[Owing to the omission of a Black Pawn at KR6, there is, unfortunately, a second solution by 1. B × P.]

Correct Solutions of both problems received from G. A. F. (Brentwood), Alpha, H. S. Brandreth, F. Hepburn, H. Le Jeune, A. S. Coulter, E. C. Willis, J. H. Carroll, Eugene Henry, G. J. Newbegin, J. M'Robert, H. W. Elcum, W. Willby, S. Cullen, A Norseman, W. Clugston.

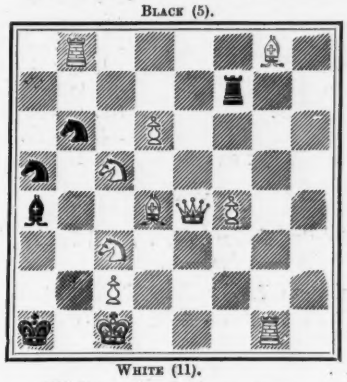
Eugene Henry.—Of the two positions which you enclose we prefer No. 2. Though it is clear that either the Rook or one of the Bishops must move (for otherwise the Rook is useless), both the key and variations are quite up to the mark. In the other the variety is hardly proportionate to the large force employed, and the stationary position of the White Queen is to be regretted. Your third position (now marked No. 2) has just reached us. The key is very pretty. Two of them shall appear in the next number.

W. Clugston.—Thanks. They shall be examined.

PROBLEMS.

No. 1.—By J. K. Macmeikan.

Black (5).

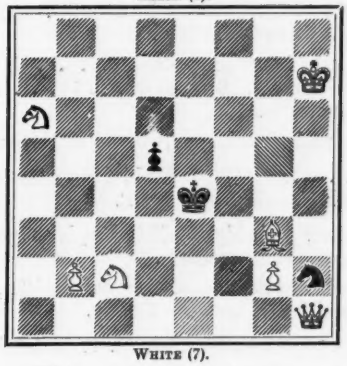


White (11).

White mates in two moves.

No. 2.—By A. G. Fellows.

Black (3).



White (7).

White mates in three moves.

The following was one of the most brilliant games in the Nuremberg Tournament :—

"Four Knights Game."

WHITE. (Maroczy.)	BLACK. (Pillsbury.)
1. P to K4	1. P to K4
2. Kt to KB3	2. Kt to KB3
3. Kt to QB3	3. Kt to QB3
4. B to QKt5	4. B to QB4 (*a*)
5. Castles	5. Castles
6. K×P	6. R to K1
7. Kt to KB3 (*b*)	7. Kt×P
8. P to Q4	8. Kt×Kt
9. P×Kt	9. B to K2 (*c*)
10. P to Q5	10. Kt to Kt1
11. B to KB4	11. P to QR3 (*d*)
12. B to QR4	12. B to KB3
13. P to Q6	13. P to QB3
14. B to QKt3 !	14. P to QKt4
15. Q to Q2	15. B to QKt2 (*e*)
16. Kt to KKt5	16. R to KB1
17. Kt to K4 (*f*)	17. P to QR4
18. P to QR3	18. Kt to QR3
19. QR to K1	19. P to QB4
20. B to Q5	20. B×B
21. Q × B	21. P to QKt5 (*g*)
22. R to K3	22. B×P (*h*)
23. R×B ! (*i*)	23. P×R
24. B to KKt5	24. Kt to QB2 (*j*)
25. Q to QB4 !	25. Q to K1
26. P×Kt (*k*)	26. Q to K4
27. R to Q1	27. KR to K1 (*l*)
28. R×P	28. K to R1
29. Q×KBP	29. Q×B
30. P to KB4	30. Q to KKt5
31. P to KR3	31. Q×R (*m*)
32. Q×Q	32. R×Kt
33. P to B8 Q's ch	33. Black resigns.

NOTES.

(*a*) Admittedly inferior to 4. . . . B to Kt5, but chosen probably as being less drawish.

(*b*) Superior to 7. Kt×Kt, QP×Kt, 8. B to B4, as played by Paulsen against Morphy. 7. Kt to Q3 is also worth considering.

(*c*) 9. . . . B to Bsq is clearly better, having regard to White's next move.

(*d*) As pointed out by Mr. Ranken, 11. . . . P to QB3 is much superior. Certainly on his next move he should play . . . P to QKt4, followed by P to Q3. Allowing the Pawn to advance to Q6 is fatal.

(*e*) Obviously he cannot play 15. . . . P to QB4 on account of the reply, 16. Q to Q5. 15. . . . P to R3 is also very dangerous.

(*f*) Very well played, preventing P to B4 for a time.

(*g*) 21. . . . R to QBsq would be useless on account of 22. Q to Kt7, followed by Q×P.

(*h*) But now probably 22. R to Bsq is as good as anything under the circumstances.

(*i*) Having two Rooks and only one Knight, he prefers in such a position to keep the Knight.

(*j*) If the Queen moves, then 25. Kt to B6ch wins.

(*k*) Inferior to 26. Kt to B6ch. Possibly Herr Maroczy was enjoying the game and did not wish to bring it to a too rapid conclusion. He threatens now Kt to Q6.

(*l*) He cannot play the other Rook to Ksq, because of B to Q8.

(*m*) If 31. . . . Q to Kt3, 32. Q×Q, P×Q, 33. Kt to Q6 wins.

The whole game is very finely played by Herr Maroczy. Mr. Pillsbury's play at the start was very weak, and he never had time to recover from its effects.

CHESS INTELLIGENCE.

It is stated that an International Tournament will be held at Buda-Pesth in the autumn; another at Berlin is projected for 1898. Between the two events a contest in Russia may be expected.

A match between Herr Lipke and Professor Berger, played under the auspices of the German Chess Association, has ended in a draw.

The tournament of the New York State Chess Association has been won by S. Lipschütz, who scored $5\frac{1}{2}$ games out of a possible 6.

The return match between Lasker and Steinitz is due to begin this month.

The Amateur Tournament at Clifton was won by Mr. H. E. Atkins, with the fine score of $8\frac{1}{2}$ out of 9. Mr. J. H. Blake was second with $7\frac{1}{2}$.

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TWO PLATES.—1. The Sooty or Brown Albatross. 2. Photograph of Nebulosities near Antares and Nu Scorpii.

NOTICES.

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